AN INVESTIGATION OF COGNITIVE STYLE AND CONSERVATION ABILITY IN FIRST-GRADE BOYS

By

GLEN HOWARD REDIEHS

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TABLE OF CONTENTS

		Page
ACKNOWLEDGMENTS		ii
LIST OF TABLES		v
ABSTRACT		vi
CHAPTER		
I	INTRODUCTION AND REVIEW OF THE LITERATURE	1
	Statement of the Problem	1
	Review of the Literature	4
	Rationale	42
	Hypotheses	45
	Summary	46
II	METHOD AND PROCEDURES	48
	Sample	48
	Instrumentation	48
	Assistants	50
	Procedure	51
	Data Collection and Analysis	56
III	RESULTS	60
IV	DISCUSSION AND CONCLUSION	72
APPENDICES		
A	SCORING CATEGORIES FOR SCST	95
B	SIGEL COGNITIVE STYLE TEST ITEM DESCRIPTIONS	101
REFERENCES		102
BIOGRAPHICAL SKETCH		108

LIST OF TABLES

Table		Page
1	Conservation of Number Studies.	14
2	Conservation of Length Studies.	20
3	Conservation of Substance Studies	22
4	Conservation of Weight Studies.	25
5	Extraneous Variables in Conservation Studies.	27
6	Stepwise Discriminant Function Analyses . . .	63
7	Stepwise Multiple Regression Analysis	67
8	Means and Standard Deviations	68

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Glen Howard Rediehs

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Chairman: Dr. William Watson Purkey
Co-chairman: Dr. Robert Emile Jester
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The purpose of this study was to investigate the relationship, if any, between cognitive style as measured by the Sigel Cognitive Style Test (SCST) and intellectual maturity as measured by success on Piagetian number, length, substance, and weight conservation tasks. Building a rationale on Halford's (1970) model for conservation training and on experiments by Yeatts and Strag (1971), Peters (1970), Garrettson (1969), and Orpet and Myers (1970), this author hypothesized that there would be a relationship among cognitive style preference and/or flexibility and conservation ability.

Scores were obtained from 37 first-grade boys for cognitive style preference, flexibility and fluency; conservation ability; Peabody Picture Vocabulary Test (PPVT) IQ; and age in months. Four major categories of style in which the subjects could score were on the SCST: Descriptive part-whole (DPW), Descriptive-global (DG), Relational-contextual (RC) and Categorical-inferential (CI). The four major

categories contained twenty subcategories. These subcategories were indicated by an abbreviation for the major style plus a number (e.g., DPW1, RC4, etc.).

To screen the independent variables, stepwise discriminant function analyses were completed. The variables which demonstrated predictive ability were then used in a stepwise multiple regression analysis.

Cognitive style was scored according to initial preference (first response for each item on the SCST) and total preference (total frequency of responses in each style category). Statistically significant results (α=.01) were obtained. Subjects' scores for their initial preference on two independent variables accurately predicted their conservation score ($p<.05$). Those two variables were cognitive style categories that used comparison between figures (RC4) and age categories (DG5) as the basis for pairing items on the SCST. The best equation ($p<.01$) used a combination of seven variables. Those variables were cognitive style categories that used comparison between figures (RC4), age categories (DG5), common role or attribute (CI2), age and sex (DG7), thematic interaction or interdependent function (RC1&5), family or other relationship (RC6) and physical attributes (DPW1) as the basis for sorting. The Descriptive part-whole and Categorical-inferential style categories were positively related to conservation scores. Descriptive-global style was negatively related to the dependent variable.

Interpreting these results as they apply to the hypothesized relationship between cognitive style preference and conservation ability was difficult. The research cited in the literature review did not provide an explanation for these results. An explanation of the findings was offered on the basis of the nature of the correlations between the independent and dependent variables and the fact that subjects who scored high on conservation ability tended to use more style categories than the subjects who scored low. This suggested that subjects who obtained higher conservation scores used the Descriptive-global style infrequently and simultaneously enlarged their use of the other style categories. Subjects who scored lower on conservation preferred the Descriptive-global style and exhibited a more limited repertoire of cognitive style.

The results gave a clear answer to the hypothesized relationship between cognitive style flexibility and conservation. Flexibility of style, fluency of response, PPVT IQ and age in months did not relate.

In summary, this study produced evidence establishing the role of cognitive style in conservation ability--a general expansion in the use of part-whole (analytical) and inferential styles and a decreased use of global style. It did not, though, indicate that one particular style preference related to conservation ability. Nor did it find flexbility of style to relate to conservation.

CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

Statement of the Problem

Jean Piaget, a Swiss psychologist, has proposed a theory of intellectual development. His theory has described changes in cognitive functioning, as they emerge, one after another, during the life of a child. Many researchers have tried to move children through the stages of intellectual development at an accelerated pace. To do this, they have attempted to discover what abilities or knowledge were necessary for a child to possess in order to proceed from one stage to the next. Then they trained children in those abilities or that knowledge.

Most studies that have sought to discover the abilities or knowledge necessary for stage transition have focused on change from the "preoperational" stage to the "operational" stage. Basically, this change is distinguished by a child's emerging ability to make logical or "operational" judgments about problems rather than perceptual or "preoperational" ones. An example of this is found in "conservation" ability. A "conserving" child knows that the amount, weight, length,

number, etc., of an item or set of items remains the same even if the shape of the item is changed or if the set of items is moved around. As long as nothing is added or subtracted, it must, logically, still be the same. A nonconserver is deceived by the change in shape or arrangement and concludes that the amount, weight, length, number, etc., have changed because the item or set of items looks different.

The question is, "What helps a child become a conserver?" Despite many experiments which have identified one or another ability or knowledge or a combination of abilites and knowledge, no one has provided a complete answer to the question. Piaget has offered some explanations and other researchers have provided others. The nature of transition from one stage to another and the experiences that help induce conservation ability have remained elusive.

Individual differences among children have been shown to have a role in the emergence of operational thought. The present study was designed to determine the degree of relationship, if any, between cognitive style and conservation ability. "Cognitive style" has been used to refer to the manner in which children have perceived the elements of a stimulus or problem. In some cases children have concentrated on the details of the stimulus or problem. In other cases, children perceived things as a whole. Or, they may have seen the relationships between the elements in the stimulus or problem. There have been a number of ways of

describing and measuring cognitive style. Some examples have been Kagan's Analytical--Non-analytical (or Relational) (Kagan, Rosman, Day, Albert and Phillips, 1964); Witkin's Field-dependent--Field-independent (Witkin, Dyk, Faterson, Goodenough and Karp, 1962); and Sigel's Descriptive, Relational and Inferential dimensions (Sigel, Jarman and Hanesian, 1967).

On the basis of research evidence, there was reason to believe that individual differences in cognitive style affected the ability to acquire conservation ability and an operational level of thought (Garrettson, 1969; Orpet and Myers, 1970; and Peters, 1970). The purpose of this study was to investigate the relationship, if any, between preference and flexibility of cognitive style as measured by the Sigel Cognitive Style Test (SCST) and intellectual maturity as measured by a composite score on number, length, substance, and weight conservation ability. If such a relationship could be shown, this would contribute to a better understanding of antecedents to conservation ability and the nature of the child's transition to conservation ability. Such knowledge could aid in the development of learning situations designed to induce conservation ability and promote overall intellectual functioning as Piaget has described it (Piaget, 1966).

Review of the Literature

There are five portions to the review of the literature. First, conservation is briefly explained. Research dealing with the same question as the present study, "What helps a child become a conserver?" is then cited. Theoretical models and experimental methods of training for conservation are included in this research. The models and the methods have identified factors that researchers claim have helped children become conservers. Cognitive style is explained in the next section. Finally, literature linking cognitive style and conservation is reviewed. This last portion of the literature review concerns those experiments that are most important for the rationale behind the hypotheses of the present study.

There are, therefore, five sections to the literature review: (a) a brief summary of Piaget's theory as it relates to conservation, (b) short explanations of ten theoretical models that have attempted to account for transition between Piaget's stages, (c) studies of attempts to train conservation, (d) theories and studies of cognitive style, and (e) literature linking cognitive style and conservation.

Piaget's Theory as it Relates to Conservation

Intelligence has been described by Piaget as being dependent on the process of growing by interacting with the environment (Piaget, 1966). Intellectual growth has been

set forth by the same theorist as a number of stages through which a child must necessarily and sequentially pass. Each stage has been characterized by an organized set of ways in which a child interacts with the environment. Piaget has identified ten such stages children encounter between birth and sixteen years of age. These stages have been conceptualized as the smaller steps within three larger periods: (a) Sensorimotor Period (birth to 2 years), (b) Preoperational Period (2 to 7 years), and (c) Operational Period (7 to 16 years).

The present study was concerned with the movement of the child from the Preoperational Period to the Operational Period. Piaget has maintained that the ability to conserve was evidence that a child was moving into the Operational Period. Conservation ability has not appeared in an all or none fashion; it has emerged gradually. Children have demonstrated partial and vacillating success before they exhibited consistently correct conservation judgments.

Piaget has shown that at about seven years of age the average child is capable of keeping track of two characteristics of an item or a set of items simultaneously while those characteristics are changed. As a result of this ability, a child can recognize that a given property of an item or a set of items, such as mass or number, remains the same, or is "conserved," even though it is reshaped or moved. The same principle applies to conservation of number,

length, height, substance, weight, volume, density, etc.--some of which appear later than others in the child's life. Conservation of substance, for example, indicates the ability to see the equality of mass between two equal substances, such as two balls of Play-Doh, even after the shape of one has been altered. In conservation of substance, a conserving child can see that changes in one dimension, such as height, of an item are offset by compensating changes in another dimension, such as width. Conservation of weight would assert a like equality, this time of weight, in spite of other changes in the object. A number conserver identifies equality in the number of items in two initially equal sets, such as two rows of pennies, despite changes in their arrangement. This same principle applies through all kinds of conservation.

In a typical test for conservation, the experimenter establishes, to the satisfaction of the subject, initial equivalence of substance, weight, number, etc., between two items or sets of items, transforms one of them, and then asks if the transformed item or set is "more," "less," or "the same" as the nontransformed item or set of items. A conserver would assert that they are still "the same" and offer a logical reason for his judgment. A logical reason would be, "because you didn't add or subtract anything," or "I could make it back like it was before."

Ten Theoretical Models of Conservation

Researchers have proposed at least ten theoretical models attempting to account for transition between Piaget's stages, i. e., what variables help a child acquire conservation ability. All have had some theoretical reasoning and some empirical evidence behind them. None has proven itself as the only correct explanation.

The ten theoretical models reviewed are: (a) Piagetian, (b) cognitive conflict, (c) operational reversibility, (d) computer analogue, (e) information processing, (f) S-R, (g) social learning, (h) learning set, (i) semantic, and (j) cue constraint. The first nine models are explained briefly. The last, "cue constraint," is dealt with more thoroughly since it was important for the rationale behind the hypotheses of the present study.

Piaget has named four factors that combine to account for the movement from one stage to the next: (a) maturation, (b) physical experience, (c) social experience, and (d) equilibration (Ginsberg and Opper, 1969). Equilibration has been Piaget's prime explanation of stage transition. Equilibration refers to an ongoing, cyclical process of intellectual balance and imbalance which a growing child experiences. As he interacts with his environment, new experiences throw him into cognitive "imbalance." This imbalance requires him to change in order to comprehend and handle the new situation and return to a state of cognitive

balance. Despite the different environment each child experiences, his interaction with its novelty forces the equilibration process into action and propels him along, from one stage to the next in Piaget's theory, in a predictable fashion.

Two other models, "cognitive conflict" and "operational reversibility," have had similarities to Piaget's model. Smedslund's (1961a) "cognitive conflict" model was built on the Piagetian model. A subject was presented with conservation trials in which it was possible for him to see a change in both shape and arrangement and also subtraction or addition of some of the material. He had to decide whether he would use perceptual cues, the change in shape or arrangement; or logical cues, the fact that some material was taken away or added, as the basis for his conservation judgment. Smedslund claimed this conflict created the cognitive imbalance that fosters the equilibration process and intellectual growth.

The "operational reversibility" model also uses a Piagetian concept. Brainerd and Allen (1971) asserted that the one common feature in successful attempts to train children to conserve was repeated exposure to "object-bound reversibility. This is a Piagetian term that refers to the realization that if one changes an object, such as the shape of a piece of Play-Doh, it can be restored or reversed to what it was before.

The remaining seven models for conservation acquisition do not have any unifying themes around which to group them and are simply other ways of explaining what it is that helps children acquire the ability to conserve, i. e., other ways to answer the question the present study seeks to answer.

Klahr and Wallace (1970) described learning to conserve as similar to programming a computer. The visual and verbal data the child receives from a conservation task are supposedly encoded, a computer-like routine constructed in the mind, and the program then executed.

Bruner (1964) viewed the ability to conserve as the result of growth in techniques of information processing in which language was the key. The use of language to make sense out of experience, that is, to process the information one gets from experience, enables the child to conserve. He is less dominated by perceptual cues and more able to use symbolic or logical processes as a result of this use of language.

In one theory it has been claimed that there are three steps in a typical conservation task: (a) initial equivalence between two items or sets of items, (b) a change in one item or set of items, and (c) a comparison between the two items or sets of items. An S-R analysis (Sigel and Hooper, 1968) considered these three steps to be three stimuli. The second step was the important one. If nothing

was added or taken away from the items during the change step, step (b), then that was the cue, or the discriminative stimulus, for the answer "the same" when the experimenter asked the subject whether the two items or sets of items were still the same or not. If the second step included addition and/or subtraction of material from the items, then that was the cue for a "more" or "less" response to the experimenter's question.

Waghorn and Sullivan (1970) found that their originally nonconserving subjects began to exhibit conservation ability as a result of viewing a film in which an experimenter and subject modeled conservation ability. They considered this support for a social-learning theory of the acquisition of conservation.

Kingsley and Hall (1967) and Rothenberg and Orost (1969) concluded that conservation ability was dependent on mastery of a sequence of component abilities. Each of these had to be learned, one after another, to a criterion level of performance.

A "semantic model" for conservation has been advanced by Braine and Shanks (1965). They pointed out that when an experimenter tests for conservation, the child has to produce the correct verbal response in order to be considered a conserver. An understanding of conservation is in the child's mind before it shows up in a test for conservation, according to Braine and Shanks, and all that a typical

conservation task shows is whether the child has learned adult definitions for such words as "same," "more," "less," etc.

The last of the conservation models described here is labeled "cue constraint." Halford (1970b) examined the equilibration and learning theory explanations for the acquisition of conservation and decided the truth was somewhere in-between. For him, conservation ability was partly the result of using the right cues. Using the right cues focuses on discrimination between stimuli and is consistent with a learning theory position. But, in consonance with equilibration, he proposed that there must also be "constraint" between the available cues. For instance, there must be constraint between quantity, height, and breadth in a conservation of substance task; or between the number of items and the spacing of items in a conservation of number task. The ability to conserve rests on the use of all cues in "truth table" fashion and in noting their compensatory relationships.

One of the hypotheses of the present study anticipated a relationship between flexibility of cognitive style and conservation ability. Part of the rationale for this hypothesis came from Halford's "cue constraint" model. If a child could see both the details in the items of a conservation task, which was characteristic of one type of cognitive style, and also the whole or relationships between the items

in a conservation task, which was characteristic of another type of cognitive style, thus demonstrating flexibility of cognitive style, he should have recognized the constraint between cues more easily and demonstrated conservation ability more readily.

The models reviewed above have all attempted to explain how a child grows from a nonconserver to a conserver. Since all of the models have a theoretical basis and some empirical evidence, the search for a single variable which helps a child attain conservation ability was very difficult. Since there was reason to believe the cognitive style preference or flexibility a child used may have helped him become a conserver (Halford, 1970b), the present study sought to find those relationships.

Studies of Attempts to Train Conservation

In the statement of the problem, it was mentioned that many researchers have tried to move children through the Piagetian styles of development at an accelerated pace. The training programs they designed to make conservers out of nonconservers all shared the concern of the present study: "What is it about the individual differences among children, or the different experiences they have, that predisposes them to move from preoperational to operational thought?"

In order to cite some answers that have been offered to this question, literature describing studies of attempts to train conservation are reviewed here. The review has five

parts: comments on successful and unsuccessful methods used to train children in the four types of conservation tasks used in this study (number, length, substance and weight) and, last, a summary of other variables (e.g., IQ, socio-economic class, conservation task complexity) that make a difference in whether a child can demonstrate conservation ability. In each of the first four sections, the reader is referred to the appropriate table which summarizes the methods used and the success or failure they produced. The review briefly explains each of the training methods that appears in the tables.

Studies dealing with conservation of number

Various training methods used in an attempt to foster the acquisition of conservation of number are summarized in Table 1. The effectiveness of thirteen different training procedures was explored in the studies reviewed here. These methods were tabulated according to success or failure and briefly defined in the following review.

The objective of reversibility training was to get the subject to realize that a transformation could be reversed. For example, a lengthened row of pennies that appeared to have more pennies could be shortened again to show one-to-one equivalence with the standard, nontransformed, comparison row.

Halford and Fullerton (1970) designed a procedure which has been labeled "cue constraint." In the training sessions,

Table 1

Conservation of Number Studies

Item	Training Method	Success	Failure
1	Reversibility	Wallach, Wall & Anderson (1967) Wallach & Sprott (1964)	
2	Cue Constraint	Halford & Fullerton (1970)	
3	Component Abilities	Rothenberg & Orost (1969)	
4	Verbal Rule Instruction	Beilin (1965)	Mermelstein & Meyer (1969)
5	Direct Reinforcement/ Reinforced Practice	Hatano & Suga (1969)* Gruen (1965)	Wohlwill (1959) Wohlwill & Lowe (1962)
6	Addition - Subtraction	Wohlwill (1959)* Wohlwill & Lowe (1962)*	Wallach, Wall & Anderson (1967)
7	Non-Verbal Reinforcement		Beilin (1965)
8	Discourage Use of Misleading Perceptual Cues		Wohlwill & Lowe (1962)
9	Cognitive Conflict	Gruen (1965)	
10	Multiple Classification		Mermelstein & Meyer (1969)
11	Language Activation		Mermelstein & Meyer (1969)
12	Verbal Orientation		Beilin (1965)
13	Equilibration		Beilin (1965)

*No statistical significance; trend only

a subject was repeatedly asked to select from several rows of items of varying lengths the one row that had the same number of items as a standard row--despite the fact that it wasn't necessarily the same length as the standard row. This method was supposed to lead a child to recognize that length of the row and spacing of the items were the important facts and that they had a compensatory relationship.

Component abilities refers to a sequence of probable steps or component skills that Rothenberg and Orost (1969) considered the antecedents to conservation. The component abilities necessary for number conservation were: (a) rote counting, (b) counting attached to objects, (c) "same" number, (d) the "same" versus "more" distinction in terms of number, (e) addition and subtraction, representing a change in number, (f) one-to-one correspondence, (g) reversibility, and (h) the distinction of "more," referring to the actual number of objects, versus "longer," referring to their arrangement in space. Each of these abilities was learned, in sequence, to a criterion level of performance. At that point, conservation ability was supposed to emerge as a result of the mastery of the prior skills.

Verbal rule instruction indicates that the subject was orally told the logical reason for a conserving response during the training procedure. He was then expected to learn it and apply it correctly.

Direct reinforcement consisted of the subject counting the two sets of items immediately after the conservation judgment to see if his prediction of the two rows being "the same" or one row "more" or "less" was correct. Success of this method was viewed as support for a learning theory model of conservation acquisition.

In the addition-subtraction procedure, one or more items were added or subtracted after initial equivalence was established between two rows of items and before one set of items was rearranged. The subject was to recognize the addition or subtraction as the important cue in making his conservation judgment.

Beilin (1965) used a non-verbal reinforcement procedure when presenting subjects with a traditional number conservation task. A correct, conserving response produced a buzzer and red token as reinforcement. An incorrect response yielded neither buzzer nor token.

Wohlwill and Lowe (1962) trained subjects to pay attention to the number cue, the number of items, instead of the length cue, the length of the array. This supposedly led to a better basis for conservation judgments and has been labeled "discourage use of misleading perceptual cues."

Smedslund's cognitive conflict procedure required that in at least some of a series of conservation tasks, the transformation of one set of items included rearrangement of the items and addition-subtraction of some items. The subject had to choose between a perceptual or a logical basis

for his conservation judgment; he had to decide if the two sets of items were still the same or not because of the way they looked or because of the addition or subtraction of items (Gruen, 1965).

Multiple classification has been shown to be a prerequisite to conservation according to Piaget. This training procedure consisted of a series of sessions in which subjects were trained to identify multiple attributes of various objects, that is, multiple ways in which objects were the same and different. With this prerequisite further developed, the child was supposedly more likely to demonstrate conservation ability.

The language activation procedure was modeled on Bruner's (1964) theory. This method focused on the linguistic aspect of the conservation test situation--hopefully decreasing the child's reliance on deceptive perceptual cues.

In the verbal orientation reinforcement, the subject was told the number concept in the instructions so that he would be verbally oriented to the relevant attribute. The subjects in this procedure were also reinforced with a token for a correct response.

Beilin (1965) attempted to imitate the equilibration procedure Smedslund (1961a) used to train weight conservation. The spatial arrangement of the items in Beilin's (1965) equilibration method underwent transformation without the addition or subtraction of items. This was supposed to

produce "cognitive uncertainty," which then forced internal reorganization of schemata and resulted in new cognitive certainty or equilibrium and, as a result, number conservation ability.

Mermelstein and Meyer (1969) attempted to replicate the training methodologies of cognitive conflict (Smedslund, 1961d), verbal rule instruction (Beilin, 1965), language activation (Bruner, 1964) and multiple classification (Sigel, Roeper and Hooper, 1966) and test for conservation along more rigid criteria. The results were, as the authors predicted, nonsignificant. Some reviewers (Brainerd and Allen, 1971) have faulted Mermelstein and Meyer for imprecise replication and 'loaded' procedures. Three of the replicated procedures were not developed originally to induce number conservation, but rather substance conservation.

The results of the experiments designed to induce number conservation did not provide a clear answer to the question the present study posed. Some of the methods revolved around Piagetian notions. Reversibility and cognitive conflict, for example, were successful, but multiple classification and equilibration were not. Addition-subtraction results were ambiguous. Other procedures used reinforcement. Non-verbal reinforcement failed and the results for direct reinforcement were equivocal. Three methodologies focused on verbal help or language activation. They were mostly unsuccessful.

What is it that helps a child acquire number conservation ability? The results of literature reviewed here, although not exhaustive of all the pertinent studies, indicated no final answer. Not all the children in any one study cited in the review were helped. The nature of the transition from nonconservation of number to conservation of number and the specific antecedents to this ability remained elusive.

Studies dealing with conservation of length

A number of training methods used in an attempt to foster the acquisition of conservation of length are summarized in Table 2. These methods were tabulated according to success or failure.

No methodologies were attempted in this review of conservation of length studies that were not explained in the review of studies dealing with conservation of number. One of the observations Smedslund (1963) made is interesting. After viewing the results of an experiment, he concluded that different children seemed helped by one or another of the several variations of the cognitive conflict procedures he used. Perhaps behind the inconsistencies and ambiguities of the research literature is that basic principle: different experiences help different children. Murray (1968) obtained statistically significant results with his reversibility training method. But, he used highly specific

Table 2

Conservation of Length Studies

Item	Training Method	Success	Failure
1	Reinforced Practice	Gruen (1965)	
2	Reversibility in a Cognitive Conflict Situation	Murray (1968)	
3	Component Abilities	Kingsley & Hall (1967)	
4	Verbal Rule Instruction	Beilin (1965)	
5	Cognitive Conflict	Gruen (1965)	
		Smedslund (1963)*	
6	Non-Verbal Reinforcement		Beilin (1965)
7	Verbal Orientation Reinforcement		Beilin (1965)
8	Equilibration		Beilin (1965)

*No statistical significance; trend only

task-related training procedures, and one might have doubts about transfer to length tasks with less similar materials.

As with the conservation of number studies cited in the previous section, those concerned with length were inconclusive. Success was more prevalent, but all children still were not helped by any one method. The abilities or knowledge necessary for conservation ability defied reduction to a simple item or combination of items.

Studies dealing with conservation of substance

A number of training methods used in an attempt to foster the acquisition of conservation of substance are summarized in Table 3.

Two new methodologies that were not explained so far were introduced in this review of conservation of substance studies. The first was Waghorn and Sullivan's (1970) film-mediated model. Nonconservers, who watched a model successfully conserve in a filmed sequence, began conserving. This result was cited as evidence for the role of social learning in conservation acquisition. Fleischmann et al. (1966) compared two variations of a traditional conservation task and a third group which received verbal feedback concerning the correctness of their conservation judgment. The feedback group improved significantly better than the traditional groups.

The manner in which the "cue constraint" method was applied to substance conservation demands explanation.

Table 3

Conservation of Substance Studies

Item	Training Method	Success	Failure
1	Reinforced Practice	Gruen (1965)	
2	Prerequisites (multiple classification, multiple relations & reversibility)	Sigel, Roeper & Hooper (1966)	
3	Prerequisites (multiple attributes, classification, seriation & reversibility)	Baptiste (1969)	
4	Film-Mediated	Waghorn & Sullivan (1970)	
5	Verbal Feedback	Fleischmann, Gilmore & Ginsberg (1966)	
6	Cue Constraint	Halford (1969; 1970a; 1970b)	
7	Cognitive Conflict	Gruen (1965) Smedslund (1961e)*	
8	Addition - Subtraction	Smedslund (1961e)*	
9	Suppression of Perceptual Cues		Strauss & Langer (1970) Fleischmann, Gilmore & Ginsberg (1966)

*No statistical significance; trend only

Halford (1969, 1970a, 1970b) believed that acquisition of conservation was not the result of one or another method. He developed the notion that a child must develop a "mental truth table" which guided his judgment according to all the possible combinations of "equal," "more," and "less" cues from quantity, height, and breadth dimensions jointly considered. His training procedures were designed simply to expose the child to many such combinations under the highest possible level of incentive. The three experiments cited here involved numerous opportunities for classifying containers requiring judgments about the combinations of the several dimensions involved. Sometimes significant and always positive results were found. It seemed that merely exposing a subject to experiences which involved compensation of height, breadth, and quantity cues and their joint constraint on each other promoted the acquisition of quantity conservation quite independently of any of the training procedures painstakingly developed to reflect Piagetian, learning theory, or other theoretical positions.

In addition to the three methodologies described above, Brison (1966) used a "no method" method. Instead of designing a training procedure which had its base in some theory, he focused on accelerating conservation itself. Nonconservers were given two days of training in which the subjects were simply presented with conservation of liquid situations in which they chose which of two deformed

quantities of juice they wanted. A significant difference between experimental and control groups was found.

An impression of a high rate of success of the substance conservation training procedures is given in Table 3. However, when it is noted that Smedslund (1961e) reported no statistical analyses and Sigel, Roeper and Hooper (1966) based their conclusions on trends and one brief statistical test, the evidence is not so clear. Success was mixed and the basic question of what it is that helps children conserve still did not have a clear, universally applicable answer. The manner of transition between stages and the antecedents to such intellectual growth were not revealed by these studies.

Studies dealing with conservation of weight

Several training procedures which have been used in an attempt to foster the acquisition of conservation of weight are summarized in Table 4.

One method found in Table 4, which was not mentioned previously, was labeled "empirical controls." This meant that the subject could observe the objects used in the task on a scale following his conservation or nonconservation prediction. Such a procedure was identical to what Smedslund and others called "direct reinforcement" elsewhere.

Two of the procedures reviewed here involved combination methods. One was successful (Overbeck and Schwartz, 1970) and one showed only positive trends (Smedslund, 1959).

Table 4

Conservation of Weight Studies

Item	Training Method	Success	Failure
1	Reinforced Practice plus Verbal Rule Instruction	Overbeck & Schwartz (1970)	
2	Component Abilities	Kingsley & Hall (1967)	
3	Direct Reinforcement/ Empirical Controls	Smedslund (1959; 1961a; 1961b)*	
4	Empirical Controls plus Addition - Subtraction	Smedslund (1959)*	
5	Addition - Subtraction	Smedslund (1961a)*	
6	Subject Active Participation		Overbeck & Schwartz (1970)
7	Suppress Perceptual Cues		Smedslund (1961c)

*No statistical significance; trend only

Another method not discussed previously in this review was "subject active participation." The experimenters who used this method, Overbeck and Schwartz (1970), hypothesized that the personal involvement of the subject in the transformation of the material used in the task was important. The results were nonsignificant.

There were still no clear answers emerging from the literature. Considering the number of studies that reported only trends, success at training for acquisition of conservation was mixed and evidence for the antecedents to or nature of transition to weight conservation was equivocal.

Literature identifying extraneous variables

The problem with the conservation training studies reviewed above is that the results did not reveal how one acquired conservation. The mechanism of transition from preoperational to operational functioning was not exposed. One way to eliminate those elements that hide the essential one(s) is to control as much extraneous variance as possible by experimental design and statistical procedure. Such variables investigated in the research reviewed for the present study are specified in Table 5.

The variables that were found to have a significant effect on measured conservation ability were of two sorts. Some were related to the condition of the subject (intelligence, socioeconomic class, age, vocabulary score and grade). Others were related to variations in training procedure

Table 5

Extraneous Variables in Conservation Studies

Item	Variable	Significant Effect	Nonsignificant/Indefinite Effect
		Number Conservation	
1	Intelligence	Dodwell (1960)	
2	High Interest Materials	Baker & Sullivan (1970)	
3	Task Complexity	Baker & Sullivan (1970)	
4	Socioeconomic Class	Baker & Sullivan (1970)	
5	Mental Set	Winer (1968)	
6	Age	Goldschmid (1967)	
7	Mental Age	Goldschmid (1967)	
8	IQ	Goldschmid (1967)	
9	WISC Vocabulary	Goldschmid (1967)	
10	Language Ability		Wohlwill & Lowe (1962) Gruen (1965)
11	Stimulus Desirability		Roll (1970)
12	Stimulus Mode		Murray (1970)

Table 5 (continued)

Item	Variable	Significant Effect	Nonsignificant/Indefinite Effect
		Length Conservation	
1	Grade	Murray (1968)	
2	Mental Age	Goldschmid (1967)	
3	IQ	Goldschmid (1967)	
4	WISC Vocabulary	Goldschmid (1967)	
5	Age	Goldschmid (1967)	
6	Addition-Substraction Ability		Gruen (1965)
7	"Game" Presentation		Murray (1968)
8	Sex		Murray (1968)
9	"Warm Ups"		Smedslund (1963)
		Substance Conservation	
1	Item Difficulty	Peisach & Wein (1970)	
2	Stimulus Setting (diameter of container)	Schwartz & Scholnick (1970)	
3	Type of Judgment (direct comparison, identity & equivalence estimates)	Schwartz & Scholnick (1970)	

Table 5 (completed)

Item	Variable	Significant Effect	Nonsignificant/Indefinite Effect
4	Composite Verbal Score	Sollee (1969)	
5	Mental Age	Goldschmid (1967)	
6	WISC Vocabulary	Goldschmid (1967)	
7	Age	Waghorn & Sullivan (1970) Fiegenbaum (1963) Goldschmid (1967)	Baptiste (1969) Sigel, Roeper & Hooper (1966)
8	IQ	Fiegenbaum (1963) Goldschmid (1967) Waghorn & Sullivan (1970)	Sigel, Roeper & Hooper (1966)
9	Task Complexity		Fiegenbaum (1963)
10	Sex		Baptiste (1969)
11	Schooling		Goodnow & Bethon (1966)
		Weight Conservation	
1	Mental Age	Goldschmid (1967)	
2	Age	Goldschmid (1967)	
3	Stimulus Mode		Murray (1970)
4	Schooling		Goodnow & Bethon (1966)

(high interest materials, task complexity, mental set, item difficulty, stimulus setting and type of judgment required). The factors that covaried with conservation helped provide insight into the characteristics of a conserving child and the type of procedures that made a difference.

Summary of conservation studies

All the methods of training for conservation of number, length, substance and weight that have been reviewed shared the basic problem of the present study, "What is it that helps a nonconserving child to grow intellectually so that he can demonstrate an understanding of conservation?" It is apparent that there is no simple answer.

Smedslund must have had part of the answer when he observed that different procedures helped different children. The search for extraneous variables turned up a number of factors relating to the condition of the child. Taking a cue from these thoughts which suggested that it was unique characterisitcs of the child that predisposed him to acquisition of conservation ability, the present study focused on one of these characteristics: cognitive style.

Theories and Studies of Cognitive Style

Neither the theoretical models for conservation nor the results of the experiments that have tried to train children to conserve have clearly answered the question, "What is it that helps a child become a conserver?" The author of the

present study hypothesized that the individual differences between children contribute substantially to the facilitation or inhibition of conservation acquisition. Much of the answer to the basic question of the current study, therefore, lay in identifying further characteristics of children that correlated with conservation ability. The dimension chosen for investigation was cognitive style.

Cognitive style has been used to refer to one way in which researchers have measured individual differences. Basically, measuring cognitive style has been an attempt to find characteristic, consistent ways that people have used in dealing with stimuli in their experience. There have been two main theoretical positions regarding cognitive style that have dominated the recent literature. One has been Field-dependence--Field-independence developed by Witkin and his associates and the other has been Analytic--Non-analytic (or Relational), researched by Kagan and his associates.

Witkin and his associates (Witkin, Dyk, Faterson, Goodenough, and Karp, 1962) defined a Field-dependent person as one who finds it difficult to overcome the influence of the field surrounding an item or to separate an item from its context. When viewing stimuli or a problem this person prefers to see it as a related whole. Field-independent subjects, on the other hand, are able to distinguish an item from its context. These subjects can handle the parts of stimuli or a problem independently from its context.

Cognitive style has been shown to influence perception of people and events in everyday experience, experience of one's self and body concept, ego defense structures, reading ability (Wineman, 1971) and other variables.

Kagan and his associates and other researchers developed a second main theoretical position. This position described two dimensions of cognitive style: (a) Analytic--Non-analytic and (b) Reflective--Impulsive. Since the SCST, which was used in the experimental portion of the present study, measures cognitive style according to the dimension established by this school of thought, the review is more extensive.

Kagan and his associates (Kagan, Moss and Sigel, 1963) began by noting that when adults were asked to sort figures on the basis of some common feature, they sorted in consistently different ways. Different subjects individually preferred using one of three bases for sorting the way they did: (a) Analytic-descriptive (similarity of visible, objective elements), (b) Inferential-categorical (categories made on the basis of inferred characteristics of the stimuli), and (c) Relational (functional or thematic interdependence between elements in a grouping). After working with these categories, the Inferential-categorical was not found to discriminate among subjects reliably and it was de-emphasized. The major dimension researched by Kagan has been an Analytic--Non-analytic (Relational) one.

Of Kagan's style measures, the Cognitive Style Test (CST) has been the most widely used with children. This test involved the presentation of 30 (originally 44) cards with three figures drawn on each card. The subject was requested to pick two of them that were alike or went together in some way. The subject revealed his cognitive style preference by telling the examiner why he thought the two he selected were alike or went together. If, for instance, a child was shown pictures of a chair, lamp and table, he might have said the chair and table went together because they both had four legs. This would have been an analytic response since he was considering visible, objective parts of the stimuli. If he said the lamp and the table went together because a lamp was always set on a table, that would have been a relational sort. He was placing them together because of their relationship to one another. Bases for analytical and relational style were available on all cards.

A great many personality variables were found to be associated with the Analytic--Non-analytic dimension (Kagan and Moss, 1962; Kagan, Moss and Sigel, 1963; Kagan, Rosman, Day, Albert and Phillips, 1964; Lee, Kagan and Rabson, 1963; Sigel, Jarman and Hanesian, 1967). Highly analytic children were persistent in problems, confident about challenging intellectual tasks, motivated for achievement-related goals, reflective, able to differentiate details of experience, able to resist the effects of distracting stimuli, less

"malleable" in their behavior and more able to form analytic concepts. They produced more word associations homologous by part of speech in a word association test, they mentioned objective parts of stimuli in the Thematic Apperception Test (TAT) before offering any thematic responses, and their style scores correlated with nonverbal subscores on the California Test of Mental Maturity (CTMM). Non-analytic (Relational) children were anxious in new social situations, expecting peer and adult rejection, impulsive, more reactive to external stimuli, less likely to differentiate complex stimulus situations, impulsively aggressive, not easily withdrawn from a group to work on a task, and hyperkinetic.

Significant sex (Sigel, 1965) and age variations in the data have been demonstrated. Boys generally have been more analytic than girls and have produced higher correlations between analytic style and the characteristics related to cognitive style. In retesting subjects a year after initial tests on the CST and on other variables, the results were more stable for girls than for boys. This finding plus the evidence that IQ for the six-to ten-year age span has been more stable for girls than for boys has led some investigators to conclude that cognitive organization is fixed earlier in girls. The relationship between Analytic--Non-analytic style and age has been shown to be linear. The older the subject, the more analytically he performed. In the lower elementary grades, boys' increase in analytic responses has been found to be faster than girls'.

Kagan and his associates also investigated the Reflectivity--Impulsivity dimension which has been seen as parallel in many ways to their Analytic--Non-analytic style (Kagan, Rosman, Day, Albert and Phillips, 1964; Kagan, Pearson and Welch, 1966; Schwebel and Bernstein, 1970; Messer, 1970; Drake, 1970; and Milgram, 1970).

To summarize, Kagan and his associates have demonstrated the existence of cognitive style along the Analytic--Non-analytic (Relational) dimension. These predispositions were demonstrated to generalize to various personality characteristics and other areas of performance. The Reflectivity--Impulsivity dimension paralleled the Analytic--Non-analytic one. Analytic--Non-analytic cognitive style appeared relatively stable over time but was subject to the influence of age and sex.

Before leaving this discussion of Kagan and the Analytic--Non-analytic dimension, one important experiment (Yeatts and Strag, 1971) is here reviewed in detail. The study is important because it challenged the unidimensionality of cognitive style and supplied the basis for the hypothesis regarding flexibility of style which was investigated in the present study.

The study investigated the relationship between an individual's ability to behave flexibly, that is, to shift cognitive style, and his academic achievement. One hundred and twenty-one fourth- and sixth-grade students were tested

on Kagan's CST and the California Achievement Test (CAT). The only difference from standard procedure was in Kagan's CST. The subject was given 45 seconds on each of nineteen test items and instructed to arrange the materials in as many ways as he was able. In scoring this test, the subject's first answer identified his cognitive style preference. He was also given a flexibility score according to the number of times he changed his cognitive style in the successive classifications. The results indicated that regardless of cognitive style preference or grade level, flexible subjects performed at a higher level of achievement. Furthermore, of the 31 subjects who were scored inflexible, 25 were at least six months below grade level, 6 at grade level and none above.

Review of Literature Linking Conservation and Cognitive Style

This section of the review of the literature again begins with the question, "What is it that helps a child to acquire conservation ability?" Ten theoretical models for conservation were cited to see what answers they offered and research attempting to train children to conserve was reviewed in hopes that they could identify experiences or individual differences that facilitated transition from nonconservation to conservation. Experiences or individual differences that could explain the appearance of conservation ability in all children were not found.

Taking a cue from Smedslund's observation that different children were helped by different training procedures and from evidence that early conservers did share some particular characteristics, attention was turned to cognitive style--one way of measuring individual differences. Perhaps cognitive style played a role in what helped a child acquire conservation ability. The two dimensions of cognitive style that Witkin and Kagan and their associates have researched were reviewed.

The present study was not the first to look for relationships between cognitive style and conservation ability (or performance on classification tasks--a prerequisite for conservation according to Piaget). The research of three investigators (Peters, 1970; Garrettson, 1967; and Orpet and Myers, 1970) who have explored these relationships is reviewed here. Since these investigations were central to the rationale behind the hypotheses of the present study, they are reviewed in detail.

Peters (1970) investigated the effectiveness of three methods of reversibility training on number conservation: (a) non-cued discovery, (b) perceptual cue-guided, and (c) verbal rule instruction under several conditions. The subjects, 131 predominantly lower socioeconomic class kindergarten children, were pretested on cognitive style. This measure was derived from a 25-object sorting task published by Educational Testing Service. The subjects were randomly

assigned to the three experimental groups and a control group. The non-cued group established equivalence between two sets of items 12 times in two training sessions utilizing wooden blocks. These blocks offered no cues that the child could use to infer one-to-one correspondence. The perceptual cue-guided group experienced a training procedure identical to the first, but the blocks had color and domino-dot cues. The verbal rule instruction group had materials and procedures like the first again. But, this time a statement of the rule, that is, the logical reason for conservation, was given following the completion of each transformation. At posttest, the means of all three training procedures were significantly higher than the control group. The verbal rule group was significantly higher than either the perceptual cue-guided or non-cue discovery groups. These two did not differ significantly. In a delayed posttest, however, both the perceptual cue-guided and verbal rule instruction groups were superior to the control and did not differ significantly from each other. The best predictor for number conservation performance on pre-and posttests was the subject's age. This was followed by language comprehension and analytic cognitive style. The last finding was evidence that there was a relationship between cognitive style and conservation ability.

Some of the reasoning the author included in his conclusion is pertinent to the present study. Since the cognitive style pretest was a measure only of the preferred way a

child perceived and organized his environment, it did not reflect an inability to organize things other ways. Peters reasoned that the training may have forced the non-analytic subjects to relinquish their preferred style and to adopt the analytic stance in the experimental situation. This meant that the ability of the subjects to be flexible in cognitive style may have enabled them to take advantage of the analytic cues offered in the training procedure, regardless of the style preference they showed on the pretest, and helped produce the positive experimental results. This was evidence that flexibility of cognitive style was related to conservation ability.

Garrettson (1969) tested 60 seven-year-old, second-grade, suburban, public school boys on three Piagetian classification tasks. Kagan's CST was administered to assess the subjects' cognitive style. Almost all of the subjects proved to be transitional between preoperations and concrete operations. No significant correlations were observed between the use of analytic style on Kagan's test and the subjects' performance on the Piagetian tasks. This evidence did not agree with that of Peters (1970), but the instrument used to measure cognitive style was different and one also had to assume that a relationship with classification ability would be like a relationship with conservation ability. Despite the fact that classification abilities have been considered by Piaget to be prerequisite to conservation ability, such an assumption was a risky one.

Part of the author's discussion of this study included the hypothesis that paying attention to fine perceptual details (Kagan's analytic style) is associated with superior classification behavior only when it is used in conjunction with attention to the part-whole or hierarchical aspects of the classes. This was evidence that flexibility of cognitive style related to classification ability--and possibly to conservation ability.

A study by Orpet and Myers (1970) of 133 first- and second-grade, middle-class subjects produced a discriminant function analysis of conservation stages by structure of intellect and cognitive style variables. The test battery, totaling 22 variables, included conservation of liquids tasks, structure of intellect tests and a cognitive style test. Chronological age was also a variable. Cognitive style was determined by the Descriptive part-whole, Descriptive-global, Relational-contextual and Categorical-inferential scores on the SCST (Sigel, 1967). The subjects were scored in one of three stages of conservation according to their persistence of judgment. The subjects were rated as nonconservers, transitional conservers or consistent conservers.

The results did not discriminate transitional conservers from consistent conservers. The variables best discriminating nonconservers from transitional conservers, in order of strength, were (a) Wechsler Intelligence Scale for

Children (WISC)--picture arrangement, (b) Nebraska Picture Associations, (c) Knox cube tapping, (d) Descriptive-global style, and (e) chronological age. Of importance for the present study was the finding that Descriptive-global scores discriminated the more successful conserver. This was evidence for a relationship between cognitive style and conservation ability. Since Orpet and Myers' research used the same instrument to measure cognitive style as the present study used, the results were the most supportive of the three studies cited here for this paper's hypotheses.

The present study, therefore, did not explore the unknown. Peters (1970) found analytic style related to number conservation. Descriptive-global style predicted conservation of liquids ability in a study by Orpet and Myers (1970). Garrettson (1969) looked for relationships between cognitive style and Piagetian classification tasks. No relationships were found. This could have been seen as contradictory evidence only if one assumed that the ability to classify was intimately connected to the ability to conserve. Some of the reasoning in the discussion sections of the studies by Peters and Garrettson suggested relationships between flexibility of cognitive style and conservation and classification. These studies provided empirical support for research into the role of cognitive style in the acquisition of conservation ability.

Rationale

This investigation sought to answer the question, "What is it that helps a child acquire conservation ability?" The review of the literature presented answers that others offered through their theoretical models and training methods. The present study hypothesized another answer--that preference and flexibility of cognitive style play a role in the ease with which a child becomes able to conserve.

There were reasons why this answer was a likely one. The rationale behind the hypotheses used supporting evidence from three areas: (a) evidence which indicated a relationship between preference in cognitive style, that is, which style categories were used most frequently throughout all test items, and conservation ability, (b) evidence which indicated a relationship between flexibility in cognitive style, as measured by the frequency of successive style alternations in multiple responses on each test item in a cognitive style test, and achievement, and (c) observations of experimenters which suggested a relationship between flexibility of cognitive style and conservation ability. The specific experimental results and research that pertained to each of these three areas are cited below:

1. Using the SCST (Sigel, 1967), Orpet and Myers (1970) found Descriptive-global style preference to be a reliable basis for predicting a child's ability in conservation of liquids. Peters (1970) obtained a measure of cognitive

style from an Educational Testing Service (1968) sorting task. He found analytic style to be a significant predictor of number conservation ability. Using Kagan's CST, Garrettson (1969) found no relationship between analytic style and success on Piagetian classification tasks. Success on such tasks has been described as a prerequisite to conservation according to Piaget. Two of these three experiments (Orpet and Myers, 1970 and Peters, 1970) succeeded in finding a relationship between cognitive style preference and conservation ability. The third (Garrettson, 1969) did not find cognitive style relating to her criterion variable. But, since classification ability was tested rather than conservation ability, her results were not as directly applicable. There was an ambiguity between the two experiments that obtained positive results. Orpet and Myers (1970) found Descriptive-global style to relate to conservation and Peters (1970) found analytic style to relate. This may have been a plain inconsistency, or it may have been that each of these two different cognitive styles related specifically to the particular conservation ability tested in each experiment.

Despite the ambiguity, these experiments suggested a relationship between cognitive style and conservation ability. Discriminant function analyses and correlational studies such as the ones cited above did not show that cognitive style caused conservation ability. Nevertheless, a

more adequate answer to the question of what it is that helps a child conserve appeared likely through further research into the demonstrated relationship.

2. There was evidence that flexibility of style was as important a characteristic as style preference. Flexibility of style referred to a subject's tendency to alternate style on successive choices within each item on a cognitive style test. Using chi-square and multiple correlation analyses, Yeatts and Strag (1971) were able to demonstrate that shift, or flexibility, in cognitive style was significantly related to academic achievement. Flexibility of style was obviously an important individual characteristic of children with consequence for their intellectual functioning. Since this was true for academic achievement, it was reasonable to hypothesize a relationship between flexibility of cognitive style and conservation.

3. The proposed relationship between flexibility of cognitive style and conservation ability was supported by research evidence. The link between flexibility of cognitive style and conservation came from three sources (Halford, 1970b; Peters, 1970; Garrettson, 1969). Halford (1970b) proposed that it was the "constraint" between more global quantitative cues and more discrete height and breadth cues that had to exist before conservation judgments were possible. It was reasoned here that the ability to perceive flexibly, to see things one way and then another, favored

the attention to such "constraint" between cues. Peters' (1970) experiment included a training procedure for number conservation. In discussing the results, he suggested that the kind of experience provided in his training procedure forced all subjects to focus on analytic cues and drop whatever preferences were shown on a style pretest. Ability to be flexible in style, and thus to use the analytic style cues offered in his training procedure, may have contributed to his positive results according to Peters, Garrettson (1969), who found no significant correlation between the subjects' use of analytic style and their performance on Piagetian classification tasks, proposed that paying attention to fine perceptual details, characteristic of analytic style, was associated with superior classification behavior only when it was used in conjunction with attention to the part-whole or hierarchical aspects of the classes. Flexibility of style would have lent itself to the recognition and use of such a broader spectrum of cues.

Halford's (1970b) "cue constraint" model and Peters' (1970) and Garrettson's (1969) investigations offered strong evidence for a relationship between flexibility of cognitive style and conservation ability.

Hypotheses

Strong evidence for a relationship between cognitive style preference and conservation ability was produced by Orpet and Myers (1970), Peters (1970) and Garrettson (1969),

The results of Yeatts and Strag's (1971) investigation, the discussion offered by Peters (1970) and Garrettson (1969) and implications from Halford's (1970b) model clearly indicated a relationship between style flexibility and conservation ability. It was, therefore, proposed to analyze the relationships between cognitive style preference and flexibility and conservation. On the basis of the supporting evidence, the hypotheses were:

1. There will be a significant relationship between preference of cognitive style as measured by the SCST and intellectual maturity as measured by a composite score on number, length, substance and weight conservation ability.

2. There will be a significant relationship between flexibility of congitive style as measured by the SCST and intellectual maturity as measured by a composite score on number, length, substance and weight conservation ability.

Summary

The purpose of this study was to investigate the relationship, if any, between preference and flexibility of cognitive style as measured by the SCST and intellectual maturity as measured by a composite score on number, length, substance, and weight conservation tasks. Considerable literature was reviewed in an attempt to explain the transition from nonconservation to conservation. Studies that offered evidence for relationships between preference of cognitive style and conservation ability, flexibility of

cognitive style and achievement, and flexibility of cognitive style and conservation ability provided a rationale for hypothesized relationships.

CHAPTER II

METHOD AND PROCEDURES

Sample

A sample of 37 first-grade, middle-class, suburban boys (almost the entire male population from that group at Lime Street Elementary School, Lakeland, Florida) was used. Such a sample was chosen because a review of the literature revealed that conservation ability had been affected by urban-rural residence, socioeconomic class and sex. Socioeconomic class and sex have been shown to affect cognitive style. Limiting the sample in the above manner limited the generalizability of the results, but helped control variance. Judgments about the subjects' urban-rural location and socioeconomic class were made on the basis of residence and vocation of the head of the house. These judgments were made in consultation with the principal.

Instrumentation

The Peabody Picture Vocabulary Test (PPVT) was administered to all subjects. This test was chosen to obtain an IQ measure because it could be quickly and easily administered and because verbal subscores have been generally the most highly correlated with overall IQ scores (Terman and

Merrill, 1937; Wechsler, 1949). Buros (1965) reported alternate form reliability at .77 at the six-year level for the PPVT. Intertest correlations were also reported between the PPVT (Form B) and the CTMM, Henmon-Nelson Tests of Mental Ability, the Stanford-Binet (S-B) and the WISC. These ranged from .58 to .80.

The SCST, Form M (1967) was administered to all subjects. The SCST consists of a set of 21 cards, each with three black and white drawings/photographs of familiar objects. Each child was asked to pick out two pictures that "go together, belong together, or are related in any way" and to state the basis for his sort. These stimuli were constructed to elicit Descriptive part-whole, Descriptive-global, Relational-contextual and Categorical-inferential concepts. Descriptions of these categories (as Sigel defines them in the SCST Manual) appear in Appendix A. Test-retest and split half reliability has varied from .60 to .80 according to Dr. Irving Sigel (personal communication, February, 1972).

Davis (1971) reported a mean test-retest reliability coefficient of .66 for Form A of the SCST when it was administered to fifth, eighth, and eleventh graders and college students. At the fifth-grade level (closest to the age of the sample in this study) the coefficients were between .67 and .87 on the four major style categories.

Standard tasks of number, length, substance and weight conservation were also administered to all subjects. The precise procedure and materials for each are described in the Procedure section.

Assistants

Nine volunteer, undergraduate students from an educational psychology class at Florida Southern College, Lakeland, Florida, were used as assistants. Two females administered the Peabody tests. They were trained by the school principal for several days before the testing was begun. Six males administered the SCST and conservation tasks. They were trained by the author of the present study for several sessions and practiced on non-sample children before testing was begun. Not all the male students tested the same number of children. But, effects due to the tester should have been negligible since all the subjects were randomly assigned to the assistants for testing. Male assistants were used to control for sex differences among the examiners affecting the subjects differently. The two females and the seventh male assisted in collecting the data.

Two students from a child psychology class at Valencia Community College, Orlando, Florida, also assisted with this study. One, a female, was trained in Smedslund's categories of justification for conservation by the author of the present study. When an interrater reliability between her and

this author reached 92 percent agreement on practice responses, she scored the justification portion of the conservation tests. The student and this author obtained 96 percent agreement in scoring the subjects' justifications. The second student, a male, was trained by the author in scoring the SCST. When an interrater reliability between him and the author of this study reached 80 percent agreement on practice responses, he scored four randomly chosen responses on the SCST for each subject. The student and this author obtained 84 percent agreement in scoring. One difficulty was encountered. Neither the student nor the author was able to satisfactorily distinguish between Relational-contextual 1 and Relational-contextual 5 style categories. As a result, they were combined in the data collection. This was not considered much of a loss in precision of measurement since the SCST Manual published with the test states, "Because of the low frequency of some of these, all Relational-contextual subcategories can be combined for analysis."

Procedure

During the first two weeks of the testing, all subjects received the PPVT. The procedures outlined in the test Manual were followed carefully.

During the third week, the SCST, Form M (1967) was administered to all subjects. The experimenter (student assistant) sat across from the subject at a table and showed

the cards to the subject one at a time. In addition to the standard experimenter's instructions for the SCST, the subject was invited to find as many ways as possible in which any two figures go together. The experimenter said, "Can you do that in another way?" after each subject's response. The subject was given forty seconds for responses. Style preference was recorded in two ways: (a) the subject's first response to each new stimulus and (b) total frequency of responses in each style category. Successive responses to the same item were analyzed as to sameness or difference of cognitive style and a flexibility score given. The flexibility score was the percentage of total categorizable responses in which there were successive alternations in styles. Only shifts in style within the responses to each test item (not including shifts between the last response of one item and the first response to the next item) were counted.

During the fourth and fifth weeks, the conservation tasks were administered. In the conservation of number tasks, the subject was presented with two parallel rows of pennies of equal length, six pennies in each row, arranged in one-to-one correspondence. The experimenter and subject counted the pennies in the experimenter's row and the subject's row to establish equivalence. The experimenter's or subject's row was lengthened or shortened (alternating these features from subject to subject) and the subject was

then asked whether he had more, less, or the same number of pennies as the experimenter. An explanation of the judgment was asked. If the response was a conserving one, the experimenter asked, "Another child told me that they were not the same; are you sure that you really have the same number as I do?" The subject's responses were recorded according to correctness, symbolic-logical explanation or not and persistence to countersuggestion.

The conservation of length task consisted of two six-inch sticks placed parallel to each other and side by side in such a way that their ends coincided. The subject was asked whether the experimenter's stick and the subject's stick were the same length. After equivalence had been established, the subject's stick or the experimenter's stick (alternating by subject) was then moved so that its end extended one inch beyond the other and the subject was asked whether his stick was longer, shorter or the same length as the experimenter's. An explanation of the judgment was asked. If the response was a conserving one, the experimenter asked, "Another child told me that they were not the same; are you sure that your stick is the same length as mine?" The subjects' responses were recorded according to correctness, symbolic-logical explanation or not and persistence to countersuggestion.

Two small Play-Doh balls of the same color and equivalent to all other properties were presented to the

subject in the test for conservation of substance. The subject was asked whether they both had the same amount of clay. Small portions were added or subtracted if necessary until the child agreed on their equivalence. One was considered the experimenter's and one the subject's. One of the balls (alternating by subject) was then flattened into a pancake shape by the experimenter. The subject was asked whether his had more, less, or the same amount of clay as the experimenter's. An explanation was requested. If the response was a conserving one, the experimenter asked, "Another child told me that they were not the same; are you sure yours has the same amount of clay as mine?" The subject's responses were recorded in terms of their correctness, symbolic-logical explanation or not and persistence to countersuggestion.

The conservation of weight task was similar to the substance task. Initial equivalence was asserted with the help of a balance scale. Clay was added or subtracted, if necessary, to establish equivalence. All the questions related to weight instead of amount, but scoring was the same.

In scoring the conservation tasks, the subject was awarded one point for each correct judgment, one point for each symbolic-logical explanation and one point for each survival to countersuggestion. This produced possible scores for each subject from 0 to 12. Sequence of conservation tasks was varied randomly to control for order effects.

All testing was done in four rooms made available by the school for the purposes of this study. Conditions were not identical for each of the subjects, but as close as possible. All sessions of cognitive style and conservation testing were tape recorded. The children's responses were transcribed off of the tapes and ultimately onto forms printed for the purpose of recording the data. This procedure was chosen because it eliminated the distraction and difficulty of a recording person in the test situation and also provided a more accurate transcription of the child's responses. The experimenters (student assistants) called for each subject from his classroom, walked with him to the testing room, being casual and friendly but not overly solicitous, tested him, walked him back to the classroom, called for the next subject, etc. The boys came from four first-grade rooms and were called for and tested in random order.

The literature indicated that error had come from variables such as varying desirability of materials (Roll, 1970), varying task complexity (Fiegenbaum, 1963), anxiety due to the strangeness or threatening nature of the test situation, unintentional reinforcement of the experimenter to the responses of the subject--perhaps somehow turning the conservation testing procedure into a training procedure, among other dangers. The test materials were designed with a sensitivity to the problems of stimulus desirability and

task complexity, and it was believed that those factors were not sufficient to affect the results. The experimenter and assistants attempted to create a test situation which was warm and allayed fears without becoming too personal or producing unintended reinforcement.

Data Collection and Analysis

THE PPVT IQ's were recorded directly on the scoring sheets provided with the test Manual and booklets. The age of each subject was recorded here in years and months and later converted into months for the analyses.

Cognitive style tests were tape recorded. All responses were then transcribed verbatim onto sheets printed for that purpose by the author. The responses were then scored independently by this author and the student with whom interrater reliability had been established. The results for each subject were tabulated. Preference according to initial preference (first response for each item) was tabulated in two ways: (a) by major categories and (b) by the 20 substyle categories. Flexibility (successive alternation or shift in style within each test item) was tallied in two ways: (a) shift between the four major categories and (b) shift between the 20 substyle categories.

The four major categories in the SCST are: Descriptive part-whole (DPW), Descriptive-global (DG), Relational-contextual (RC), and Categorical-inferential (CI). It

should be remembered that only 20 substyle categories appear in the data because two substyles, Relational-contextual 1 and Relational-contextual 5, were combined in the statistical analysis.

The conservation task sessions were also tape recorded and all the children's responses were then transcribed onto forms printed for the recording of these data. The justification responses were then scored independently by this author and the student with whom interrater reliability had been established. The results for each student were tabulated. The number of points awarded for conservation on all four conservation tasks, the number of points for symbolic-logical justification on conserving judgments and the number of points given successful resistance to counter-suggestion and extinction were noted. A total, composite score was then figured.

At the conclusion of the data collection, there were scores on each subject for:

I. Cognitive Style
   - A. initial preference on four major styles
   - B. total preference on four major styles
   - C. initial preference on 20 substyles
   - D. total preference on 20 substyles
   - E. flexibility of style between major categories
   - F. flexibility of style between all categories
   - G. fluency

II. Conservation--composite scores for all points on all tasks

III. PPVT IQ

IV. Age in months

This information was then punched onto data cards. The data were analyzed using regression techniques. To screen the data and reduce the number of independent variables, discriminant function analyses were completed. Then, a multiple regression analysis was completed on the variables which proved of value in the discriminant function analyses. The multiple regression analysis identified the combination of independent variables with the most power for predicting a subject's conservation score.

Stepwise discriminant function analyses were run using the BIOMED 07M program. The results of a discriminant function analysis indicate to a researcher whether any of the data he has for his subjects are useful in predicting to which of two or more groups the subjects belong. In the present study, they indicated the usefulness of cognitive style preference and/or flexibility, fluency of response, PPVT IQ, and age for predicting whether each subject was a conserver or a nonconserver. The stepwise portion of the analysis indicates which variable is the most powerful in predicting group membership; and then, in order of predictive power, which further variables, in combination with those already entered, are most helpful. Membership in the conserving or nonconserving group was the dependent variable (the one to be predicted) in all five analyses. The independent variable was the score on some characteristic of the subject (e.g., cognitive style preference) that was hypothesized to relate to or predict the dependent variable.

The subjects were divided into two groups for purposes of the discriminant function analyses--conservers and non-conservers. A total of five analyses were completed. The first analysis used initial preference scores on each of the four major style categories as the independent variable; the second, initial preference scores on the substyle categories; the third, total preference scores on each of the four major style categories; the fourth, total preference scores on the substyle categories; and fifth, an analysis was done using the two flexibility scores, PPVT IQ, age in months and fluency (total number of categorizable responses) as the independent variables.

The independent variables that demonstrated power in the discriminant function analyses were used in a multiple regression analysis. This analysis was run using the BIOMED 02R program. The results of a multiple regression analysis indicate to a researcher whether there is a combination of independent variables that will predict (when entered into an equation) the score of each subject on the dependent variable. In the present study, they indicated a combination of measures of cognitive style that, when entered in a regression equation, predicted at a statistically significant level the conservation scores of the subjects.

CHAPTER III

RESULTS

The conservation scores were bimodally distributed. Most of the subjects clustered around either low scores or high scores and few were in the middle. Twenty-three subjects scored between 0 and 5 points on the composite conservation score. They were classed as nonconservers. Thirteen subjects scored between 7 and 10 points. They were classed as conservers. One subject who scored 6 points was dropped. No subjects scored 11 or 12 points. The distribution of conservation scores is shown in Figure 1.

A total of five stepwise discriminant function analyses were completed using the BIOMED 07M program. The first analysis used initial preference scores on each of the four major style categories as the independent variable; the second, initial preference scores on the substyle categories; the third, total preference scores on each of the four major style categories; the fourth, total preference scores on the substyle categories; and fifth, an analysis was done using the two flexibility scores, PPVT IQ, age in months and fluency as the independent variables.

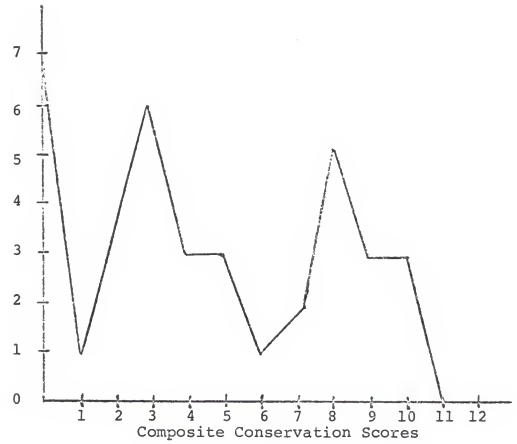

Figure 1. Distribution of Conservation Scores

In those cases in which a substyle category was never used by any conserving or nonconserving subject, that variable was omitted from the analysis in which it occurred. This prevented artificial relationships from appearing. Using such variables would have meant that points (0,0) would have been entered into the equation rather than measures of variance. As a result, six variables were dropped from the discriminant function analysis using initial preference for the independent variable. Two variables were dropped from the analysis that used total perference.

The approximate multivariate F values of all independent variables in predicting the conservation classification of the subjects are presented in Table 6. In each instance, the variables are listed in the order in which they were stepped into the equation. The numbers of conserving and nonconserving subjects who were classified as conservers and nonconservers on the basis of the variables entered into the equation at each step are also reported in Table 6.

The only independent variable that demonstrated statistically significant power was initial preference on the substyle categories. With four variables entered, the .05 level of significance was reached. Optimum power for classifying ($p < .01$) was obtained from an equation in which seven variables had been stepped. Therefore, a multiple regression analysis was performed on these data. The BIOMED 02R program was used. The fourteen variables that were analyzed in

Table 6

Stepwise Discriminant Function Analyses

Step	Variable Entered	Approximate Multivariate F	df	Significance Level of Equation	Nonconservers Classified as Nonconservers	Nonconservers Classified as Conservers	Conservers Classified as Conservers	Conservers Classified as Nonconservers
			Initial Preference					
			Major Styles					
1	DPW	2.7478	1,34	NS	16	7	9	4
2	CI	2.1624	2,33	NS	14	9	10	3
3	RC	1.7140	3,32	NS	12	11	10	3
4	DG	1.6333	4,31	NS	16	7	10	3
			Substyles					
1	RC2	2.6122	1,34	NS	19	4	6	7
2	DPW1	2.5159	2,33	NS	15	8	9	4
3	RC1&5	2.6923	3,32	NS	16	7	9	4
4	RC6	2.9904	4,31	S($p<.05$)	19	4	9	4
5	DG7	3.4366	5,30	S($p<.05$)	18	5	10	3
6	CI2	3.5058	6,29	S($p<.05$)	18	5	10	3
7	DG5	4.1207	7,28	S($p<.01$)	19	4	11	2
8	RC4	3.7995	8,27	S($p<.01$)	20	3	10	3
9	CI4	3.4499	9,26	S($p<.01$)	19	4	11	2
10	CI6	3.2106	10,25	S($p<.01$)	20	3	12	1
11	DG4	2.8764	11,24	S($p<.05$)	20	3	12	1
12	DPW2	2.5535	12,23	S($p<.05$)	20	3	11	2

Table 6 (continued)

Step	Variable Entered	Approximate Multivariate F	df	Significance Level of Equation	Nonconservers Classified as Nonconservers	Nonconservers Classified as Conservers	Conservers Classified as Conservers	Conservers Classified as Nonconservers
13	DG6	2.2586	13,22	S(p<.05)	20	3	12	1
14	CI1	2.0040	14,21	NS	20	3	12	1
				Total Preference				
				Major Styles				
1	CI	2.6280	1,34	NS	13	10	7	6
2	DPW	1.5542	2,33	NS	13	10	8	5
3	DG	1.1137	3,32	NS	13	10	7	6
4	RC	.8160	4,31	NS	13	10	7	6
				Substyles				
1	RC2	3.4434	1,34	NS	19	4	6	6
2	CI7	2.7494	2,33	NS	18	5	7	6
3	RC6	2.4997	3,32	NS	20	3	7	6
4	CI6	2.6076	4,31	NS	16	7	8	5
5	CI5	2.5180	5,30	NS	16	7	8	5
6	CI4	2.1683	6,29	NS	16	7	8	5
7	DG4	1.9178	7,28	NS	17	6	8	5
8	DPW1	1.7310	8,27	NS	18	5	9	4
9	DG7	1.6327	9,26	NS	19	4	8	5
10	DG5	1.5292	10,25	NS	19	4	8	5
11	RC1&5	1.4148	11,24	NS	19	4	10	3
12	RC4	1.4144	12,23	NS	20	3	10	3

Table 6 (continued)

Steps	Variable Entered	Approximate Multivariate F	df	Significance Level of Equation	Nonconservers Classified as Nonconservers	Nonconservers Classified as Conservers	Conservers Classified as Conservers	Conservers Classified as Nonconservers
13	DPW3	1.3581	13,22	NS	18	5	11	2
14	CI2	1.2930	14,21	NS	18	5	10	3
15	RC3	1.2595	15,20	NS	18	5	11	2
16	CI1	1.1265	16,19	NS	18	5	11	2
17	DPW2	1.0072	17,18	NS	18	5	11	2
18	DG6	.9001	18,17	NS	18	5	11	2
			Other Variables					
1	Fluency	.8798	1,34	NS	14	9	4	9
2	Flexibility between all styles	.6717	2,33	NS	10	13	10	3
3	Peabody IQ	.4787	3,32	NS	12	11	8	5
4	Age in months	.3636	4,31	NS	12	11	9	4
5	Flexibility between major styles	.2815	5,30	NS	12	11	9	4

the discriminant function analysis using initial preference on substyle were entered into the multiple regression analysis. The dependent variable was conservation score. The results of this analysis are presented in Table 7. Conservation scores were predicted at the .05 level with two variables entered. With seven variables entered, maximum power ($p < .01$) was obtained. The means and standard deviations of all variables are presented in Table 8.

In summary, the subjects' conservation scores were bimodally distributed. This distribution allowed reasonable division of the subjects into conservers and nonconservers. Five stepwise discriminant function analyses were completed. These tested the power of initial cognitive style preference, total style preference, style flexibility (measured in two different ways), PPVT IQ, age, and fluency in predicting the classification of the subjects as conservers or nonconservers. The results of these are presented in Table 6. Significant results were produced when initial preference was used as the independent variable. A multiple regression analysis was performed on the fourteen measures on this variable and the dependent variable, conservation score. The results of the multiple regression analysis are reported in Table 7. With seven variables entered into the equation, optimum power was obtained. The variables that were able to predict the subjects' conservation scores were measures of the subjects' tendency to pair the pictures in the item on the SCST

Table 7

Stepwise Multiple Regression Analysis

Step	Variable	F	df	Significance	Multiple R	Correlation with Conservation
1	RC4	3.242	1,34	NS	.2950	-.295
2	DG5	3.507	2,33	S(p<.05)	.4187	-.270
3	CI2	3.167	3,32	S(p<.05)	.4785	+.232
4	DG7	3.236	4,31	S(p<.05)	.5427	-.074
5	RC1&5	3.085	5,30	S(p<.05)	.5827	+.031
6	RC6	3.583	6,29	S(p<.01)	.6525	-.214
7	DPW1	4.010	7,28	S(p<.01)	.7075	+.201
8	DG6	3.758	8,27	S(p<.01)	.7259	-.260
9	RC2	3.484	9,26	S(p<.01)	.7394	_.223
10	DG4	3.122	10,25	S(p<.05)	.7454	-.258
11	CI6	2.799	11,24	S(p<.05)	.7496	+.059
12	CI4	2.515	12,23	S(p<.05)	.7533	+.240
13	DPW2	insuff.				+.275
14	CI1	insuff.				+.092

Table 8

Means and Standard Deviations

Variable	Nonconservers		Conservers	
	Mean	Std.Dev.	Mean	Std.Dev.
	Initial Preference			
DPW	3.609	3.340	5.538	3.382
DPW1	1.522	2.274	2.385	2.631
DPW2	2.087	2.130	3.000	1.871
DPW3	0.000	0.000	0.154	0.376
DG	2.304	2.285	1.769	1.013
DG4	0.391	0.583	0.308	0.480
DG5	0.696	1.550	0.538	0.519
DG6	0.565	0.728	0.462	0.776
DG7	0.652	0.935	0.462	0.877
RC	4.130	3.321	4.615	3.404
RC1&5	2.304	2.363	3.462	2.634
RC2	0.217	0.518	0.538	0.660
RC3	0.043	0.209	0.000	0.000
RC4	1.087	1.345	0.462	0.877
RC6	0.391	0.656	0.154	0.376
RC7	0.087	0.288	0.000	0.000
CI	3.478	2.810	5.000	2.345
CI1	1.957	2.078	2.231	2.127
CI2	1.000	1.314	1.615	1.387
CI3	0.000	0.000	0.077	0.277
CI4	0.304	0.635	0.615	0.870

Table 8 (continued)

Variable	Nonconservers		Conservers	
	Mean	Std.Dev.	Mean	Std.Dev.
CI5	0.000	0.000	0.154	0.376
CI6	0.217	0.671	0.308	0.480
CI7	0.000	0.000	0.000	0.000
	Total Preference			
DPW	6.304	7.600	9.308	7.782
DPW1	2.348	3.511	3.308	4.231
DPW2	3.870	4.605	5.846	4.723
DPW3	0.087	0.417	0.154	0.376
DG	3.043	3.843	2.462	2.066
DG4	0.435	0.590	0.462	0.660
DG5	1.174	3.525	0.692	0.630
DG6	0.070	0.876	0.692	0.630
DG7	0.739	1.096	0.615	1.121
RC	9.087	1.774	8.846	8.122
RC1&5	5.348	6.135	6.385	5.576
RC2	0.217	0.518	0.615	0.768
RC3	0.043	0.209	0.077	0.277
RC4	2.304	4.061	1.308	2.287
RC6	1.087	1.782	0.538	0.967
RC7	0.087	0.288	0.000	0.000
CI	5.217	4.199	7.461	3.573
CI1	2.870	3.065	3.308	2.983
CI2	1.478	1.780	2.231	2.421

Table 8 (continued)

Variable	Nonconservers		Conservers	
	Mean	Std.Dev.	Mean	Std.Dev.
CI3	0.000	0.000	0.077	0.277
CI4	0.435	0.662	0.692	0.947
CI5	0.140	0.458	0.154	0.376
CI6	0.435	0.896	0.769	0.927
CI7	0.043	0.209	0.231	0.439
Flexibility Between Categories	12.261	11.001	12.462	8.705
Flexibility Between and Within Categories	19.348	18.059	19.077	13.219
Conservation Score	2.261	1.814	8.538	1.050
PPVT IQ	106.348	19.242	111.000	18.102
Age in months	80.783	4.502	80.538	3.526
Fluency	23.217	16.251	28.000	11.299
Number of Different Styles Used	6.83	3.01	8.85	2.23

on the basis of comparison between figures (RC4), age categories (DG5), common role or attribute (12), age and sex (DG7), thematic interaction or interdependent function (RC1 & 5), family and other relationship (RC6), and physical attributes (DPW1). The means and standard deviations of all variables are reported in Table 8.

CHAPTER IV

DISCUSSION AND CONCLUSION

To aid the reader in following this discussion, a brief, descriptive caption for each subcategory, followed by the symbol, has been used as the subcategories occur in the text. The caption refers to the category of reason a subject gave for pairing two of three pictures presented in each item on the SCST. For a fuller description of each category, the reader is referred to Appendix A.

First Hypothesis

The first hypothesis was: There will be a significant relationship between preference of cognitive style as measured by the Sigel Cognitive Style Test and intellectual maturity as measured by a composite score on number, length, substance and weight conservation ability. Four stepwise discriminant function analyses were completed in testing this hypothesis. The independent variables were: 1) initial preference on the four major style categories, 2) initial preference on the substyle categories, 3) total preference on the four major style categories, and 4) total preference on the substyle categories. Neither analysis

using total preference produced statistically significant results. Likewise, the results of the analysis utilizing initial preference on the four major styles were statistically nonsignificant. There were statistically significant results, however, when initial preferences on the substyle categories were the independent variables.

The results are reported in Table 6. Statistically significant ($p < .05$) results were obtained in the fourth step of the analysis which employed initial preference on the subcategories as the independent variable. The four variables that were entered into the equation at that point were those which indicated the subjects' tendency to pair pictures on the basis of common locale (RC2), physical attributes (DPW1), thematic interaction or interdependent function (RC1 & 5), and family or other relationship (RC6). The approximate multivariate F increased through the seventh step. At this step significance reached the .01 level and only six subjects were misclassified. The fifth through the seventh step added these three style categories: age and sex (DG7), common role or attribute (CI2), and age (DG5). Stepping in further variables progressively lowered the approximate F value and correctly classified only two more subjects--even through the fourteenth step. Adding the next three variables--comparison between figures (RC4), common affect (CI4) and inferred attribute or unseen part (CI6)—did not change the level of significance. However,

significance dropped to the .05 level when the next three variables were entered: status or occupation (DG4), description of objects (DPW2), and sex (DG6). When the final variable, common behavior of function (CI1), was entered, the predictive power of the equation became non-significant. These results indicated that the subjects' membership in either the conserving or nonconserving groups could be predicted on the basis of the subjects' scores on seven substyle categories.

The variables useful in classifying subjects into two categories, as the discriminant function analysis did, might not be the same as those that predict the subjects' conservation score, as a multiple regression analysis does. Said another way, comparing continuous data (style scores) with discontinuous data (conserving or nonconserving groups) might not produce the same results as comparing continuous data (style scores) with continuous data (conservation scores). The latter is to be preferred in answering the hypothesis of the present study.

In order to obtain the most powerful combination of variables from the 14 substyle categories, these 14 measures and conservation score, the dependent variable, were placed in a stepwise multiple regression analysis. The results are reported in Table 7.

Seven of the first eight variables in the discriminant function analysis were the first seven in the multiple regression analysis; only the order in which they were stepped

into the equation differed. The variable that was entered first in the discriminant function analysis, common locale (RC2), was not entered until the ninth step in the multiple regression analysis.

The results of the multiple regression analysis indicated that an equation with only two independent variables, comparison between figures (RC4) and age categories (DG5), will predict the subjects' conservation scores at a statistically significant level ($p < .05$). The addition of four more variables raised the level of statistical significance to .01. These four were common role or attribute (CI2), age and sex (DG7), thematic interaction or functional interdependence (RC1 & 5) and family or other relationship (RC6). Entering one further variable, physical attributes (DPW1), to the equation, raised the F ratio considerably and accounted for a fair amount of variance. Adding more variables helped to account for very little additional variance and, after the tenth step, lowered the statistical significance to the .05 level. Two of the 14 variables, description of objects (DPW2) and common behavior or function (CI1), obtained an insufficient F for entry into the equation.

Therefore, as predicted in the first hypothesis, there was a statistically significant relationship between cognitive style preference and composite scores on several Piagetian conservation tasks. This relationship was

demonstrated between initial preference cognitive style scores and conservation scores. Of the variables entered in the first seven steps of the multiple regression analysis, all four major style categories were represented. Four of these variables were preferred by subjects with low conservation scores. These were comparison between figures (RC4), age categories (DG5), age and sex (DG7) and family or other relationship (RC6). Three of the seven variables were preferred by subjects with high conservation scores. These were common role or attribute (CI2), thematic interaction or interdependent function (RCl & 5), and physical attributes (DPWl).

Patterns were identified among the major styles as they were represented by the subcategories used in the multiple regression analysis. One Descriptive part-whole variable, physical attributes (DPWl), appeared in the seventh step and was positively correlated with the dependent variable. Two Descriptive-global variables, age categories (DG5) and age and sex (DG7), occurred in the second and fourth steps. Both correlated negatively with conservation score. The Relational-contextual major category appeared three times. Comparison between figures (RC4), thematic interaction or interdependent function (RCl & 5) and family or other relationship (RC6) were entered in the first, fifth and sixth step. Two of these, comparison between figures (RC4) and family or other relationship (RC6), were correlated negatively

with conservation score. Conservation correlated positively with thematic interaction or interdependent function (RC1 & 5). One Categorical-inferential variable, common role or attribute (CI2),was entered in the third step and was positively correlated with conservation score.

Summarized another way, positive relationships existed between subcategories from two major styles, Categorical-inferential and Descriptive part-whole and conservation scores. There were negative relationships between two subcategories of the Descriptive-global style and the dependent variable. The relationship of the subcategories within the Relational-contextual major category was ambiguous.

These results implied that one can predict a given subject's conservation score by his preferred use of the common role or attribute (CI2), physical attributes (DPW1) and thematic interaction or interdependent function (RC1 & 5) cognitive styles and by his infrequent use of age categories (DG5), age and sex (DG7), comparison between figures (RC4), and family or other relationship (RC6) styles. Furthermore, one can predict a subject's conservation score at a lower level of statistical significance ($p < .05$) on the basis of a subject's score on just two variables--his infrequent use of comparison between figures (RC4) and age categories (DG5).

Why was a combination of these particular styles capable of predicting what a subject's conservation score would be?

Was there something shared by CI2, DPW1 and RC1 & 5 that a subject needed to use to be able to score high on conservation? Or, was there something shared by DG5, DG7, RC4 and RC6 that a subject needed to ignore to be able to score high on conservation?

CI2, DPW1 and RC1 & 5 appeared an unlikely combination. One might have expected a clear preference of one style or another, but a combination of three of the four major styles was confusing. For a subject to choose the CI2 category, he was grouping objects in the SCST on the basis of an inherent common role, class or attribute (e.g., both figures were animals, ways of transportation, tools, professional people, violent, juicy, etc.). When a subject chose the DPW1 category, the basis for the grouping was the physical attribute or property of the materials in the pictures (e.g., color, texture, shading, shape). Sorts based on themes, plots or stories (e.g., he killed this man, she is giving him food, etc.) and sorts in which objects were grouped together on the basis of their interdependent use or function (e.g., the hammer is being used to bang the nail, ham and bread make a sandwich, etc.) were scored as RC1 & 5 cognitive style. The tendency for a subject to prefer sorting on the basis of inherent, common characteristics (CI) or on the basis of observable parts of the stimulus (DPW) or on the basis of relationships (RC) was found to be statistically independent by Sigel. There was no reason for the

combination of these styles in a regression equation predicting conservation scores. The literature cited in this study did not provide an explanation for such results.

Was there something shared by DG5, DG7, RC4 and RC6 that a subject needed to ignore to be able to score high on conservation? In order to score on DG5, a subject sorted on the basis of discrete age categories (e.g., children, old people, adults, etc.). Sorting on the basis of age and sex (old men, young women, boys, girls) indicated a DG7 cognitive style. RC4 sorts were those based on a comparison between two figures (e.g., this one is better than that one) and RC6 sorts indicated grouping on the basis of an understood relationship between the figures (e.g., mother-son, doctor-nurse, teacher-student, etc.). There was no common quality between sorts based on the total objective manifestations of the stimuli (DG) and those based on relationships (RC). The literature cited in this study did not provide an explanation for such results.

In order to explain the results, the author attempted to discover the reason why the variables entered in the multiple regression analysis were able to predict the conservation score of the subjects. There was no explanation provided by the literature cited in the present study to support the results. The more frequent use of common role or attribute (CI2), physical attributes (DPW1), thematic interaction or interdependent function (RC1 & 5) and the

less frequent use of age categories (DG5), age and sex (DG7), comparison between figures (RC4) and family or other relationship (RC6) predicted a higher score on conservation.

Another observation about the results explained part of what happened. The correlations between the fourteen independent variables used in the multiple regression analysis and the dependent variable, conservation score, indicated a clear pattern. Descriptive part-whole styles and Categorical-inferential styles were consistently positively related to conservation score. Descriptive-global styles were consistently negatively related. The Relational-contextual style was ambiguous. A nonconserver preferred Descriptive-global styles and, to some extent, Relational-contextual styles. A conserver rejected the Descriptive-global style for Descriptive part-whole and Categorical-inferential styles, and to some extent, Relational-contextual styles. This suggested that the combination of variables entered in the multiple regression analysis may have been the result of the tendency for a subject who obtained a higher conservation score to choose a broader range of styles while rejecting the Descriptive-global style. Conversely, the subject who obtained a lower conservation score preferred the Descriptive-global style and used a more limited range of styles.

Additional evidence for this explanation was provided by a simple tabulation of the styles used by the conservers

and nonconservers (as conservers and nonconservers were defined in the discriminant function analyses). This showed that the conservers used a mean of 8.85 different styles. This compared with a mean of 6.83 different styles used by nonconservers. No subject in either classification used more than 11 different styles (of the possible 20) in all his responses on the SCST. The tabulation indicated that 10 of the 13 conservers (77%) used between 8 and 11 different styles. Only 10 of the 23 nonconservers (43%) used that many different styles.

Another indication of the suggested distinction between conservers and nonconservers was found in the means of response frequencies tabulated according to initial preference. Of the 20 substyles which could be used by the subjects, 11 of them were preferred by the conservers, 8 by the nonconservers, and one was not used by either group of subjects. These means of response frequencies implied that nonconservers had fewer favorite styles and a more limited repertoire. Conservers, on the other hand, used more styles.

The total number of categorizable responses on the SCST was higher for conservers than nonconservers (Table 8). It was, therefore, possible that the preference for more styles that the conservers displayed was only a result of this higher fluency of response. Or, as suggested here, it may truly have been the result of a larger repertoire.

One explanation of the combination of independent variables (cognitive styles) that were entered into the multiple regression analysis to predict the dependent variable, conservation score, has been offered. Inasmuch as no literature cited in this study offered an explanation for the variables that emerged, another observation was made. This observation noted two things:

1) the pattern of correlations between independent and dependent variables, and

2) the number of styles used by conservers in comparison to nonconservers.

Categorical-inferential and Descriptive part-whole styles were consistently positively related to conservation score. Descriptive-global was negatively related. Relational-contextual was ambiguous. Conservers demonstrated a wider choice of styles.

Therefore, it was concluded that the results of the multiple regression analysis were a consequence of the tendency for subjects who scored higher on conservation to differ from subjects who scored lower by the increased scope of cognitive style used rather than by transition to a new but also limited repertoire.

This was also the response to the first hypothesis. There was a significant relationship between cognitive style as measured by the SCST and intellectual maturity as measured by a composite score on number, length, substance and weight conservation ability. But, this significant

relationship was a result of the difference in number of styles used by low and high scorers on conservation rather than by a unique and contrasting set of styles used by the two groups of subjects.

What were the theoretical implications of the preceding discussion for the hypothesis that there would be a relationship between cognitive style preference and conservation ability? Several studies cited in the review of the literature found a relationship. Peters (1970) found that analytic style was the third most powerful predictor of number conservation abilities among kindergarten children. In an experiment with second-grade suburban public school boys, Garrettson (1969) did not find a relationship between the use of analytic style and Piagetian classification tasks. Orpet and Myers (1970) administered the SCST (1967) to 133 first- and second-grade middle class subjects and found Descriptive-global style the fourth most powerful variable in discriminating ability in conservation of liquids.

Both styles mentioned in the literature above as predicting conservation ability, that is, analytic style (Peters, 1970) and Descriptive-global style (Orpet and Myers, 1970) would find support for their results in the present study. The first study would find this support because of a positive relationship between Descriptive part-whole style and conservation ability and the second because of a negative relationship between Descriptive-global style and conservation scores.

The results of the present study did not indicate that one particular cognitive style preference related to conservation ability. It produced evidence establishing the role of cognitive style in conservation ability--if only a general expansion in the use of part-whole (analytical) and inferential styles and a decreased use of global style.

Second Hypothesis

The second hypothesis was: There will be a significant relationship between flexibility of cognitive style and intellectual maturity as measured by the composite conservation score. Flexibility of style was measured in two different ways: (a) flexibility of style as measured in an overall percentage of total responses that shifted between the four major style categories within each item on the SCST and (b) flexibility of style as measured in an overall percentage of total categorizable responses that shifted between the 20 substyle categories within each item on the SCST.

A stepwise discriminant function analysis was done using the two sources of data and the results (Table 6) produced neither statistical significance nor mentionable trends. The number of shifts of style a subject made in responding to individual items on the SCST had no predictive value for classifying him as a conserver or nonconserver. In a tabulation of frequency of shifts (Table 8), the

mean score on both measures of flexibility did not differ by more than .3 between conservers and nonconservers. The correlation coefficient between these two measures of flexibility was .88 and appeared to carry the same meaning. A subject who shifted between major styles shifted in a like manner between the substyles.

What does this mean theoretically? The rationale behind the hypotheses cited theory and research which indicated the plausibility of a relationship between flexibility of cognitive style and conservation ability. Halford (1970b) argued that there must be "constraint" between available cues before a child can conserve. He must both discriminate the cues and see their compensatory relationship. Yeatts and Strag (1971) claimed that not only initial preference but also flexibility of cognitive style is associated with academic achievement. Peters (1970) found analytic sort related to number conservation. According to the same author, ability to be flexible in style may have contributed to the positive results of his training procedure. Garrettson (1969) did not find any significant relationships between analytic style and Piagetian classification tasks. But, she stated that paying attention to fine perceptual details was associated with superior classification when it was used in conjunction with attention to part-whole or hierarchical aspects of the classes. The present study did not support these research findings or the

rationale built on them. Discriminant function analyses attempting to identify conservers and nonconservers on the basis of flexibility of style did not produce significant results nor mentionable trends.

IQ, Age and Fluency

There were a number of other independent variables considered in this study. Some of the literature (Dodwell, 1960; Murray, 1968; Fiegenbaum, 1963; Goodnow and Bethon, 1966; Goldschmid, 1967) found that IQ related to conservation ability. Therefore, a PPVT was administered to all the subjects. Intelligence as measured by this instrument did not relate significantly to conservation ability (Table 6). A glance at the mean scores on IQ (Table 8) indicated conservers averaged less than five IQ points higher than nonconservers. With an N of 37, not much could be said on the basis of that difference. Since the IQ scores obtained by the researchers cited above were measures of more general intelligence, it could be that the PPVT IQ does not correlate very highly with conservation. Nevertheless, as mentioned in the Instrumentation section, the vocabulary subscores of the S-B and WISC correlate highly with the full scale scores of the PPVT. Also, congruent validity of the PPVT as reported in the Instrumentation section of this study is high. Nevertheless, for this study, IQ did not emerge as a significant predictor of conservation ability.

Another variable mentioned in the literature as predictive of conservation ability was age (Baptiste, 1969; Fiegenbaum, 1963; Goldschmid, 1967). This was controlled in the present study by selecting subjects in the same grade. Although it was expected that older children would be more likely to conserve than younger children, this didn't happen. The difference in the average age of the conservers and nonconservers was less than .3 of a month--and that was in the opposite direction than expected (Table 8). The F value obtained in the discriminant function analysis based on age in months was extremely low (Table 6).

The last variable to be discussed is a measure of the total number of categorizable responses, or fluency. Yeatts and Strag (1971) found that fluency related to intellectual performance. In the present study the F obtained in a discriminant function analysis was nonsignificant.

Problems

The author of the present study found difficulties with the measures used for scoring. One difficulty was the manner in which conservation ability was assessed. The opportunity for variance provided by a total range of 0 - 12 in the scores was less than optimal. Inasmuch as no child actually scored above 10, such opportunity was even less. When one looked over the results on the conservation tasks, it became apparent that the extinction procedure was not very powerful. Only in three instances did the conserving subject

fail to resist the countersuggestion in the extinction procedure. This means that only 8 of the possible 12 points on the conservation score distinguished between subjects. Also, since a composite score was used in the statistical analyses rather than separate scores on each of the conservation tasks, it was possible that relationships between one or another conservation task and cognitive style were masked by the composite score measurement.

There were problems associated with using the SCST at this age level. The pictures presented in the text booklet were so poor in their detail that some children were not able to recognize them. Particular difficulties were encountered with items 3, 6, 16, 19, 21, and 31. The reader is referred to Appendix B for descriptions of each of the test items. The photographs of a snake, monkey, old man and old woman, ham slice, nurse and melon were not recognized on a number of occasions.

A second problem with the use of the SCST at this age level was that some children could not articulate their choices and reasons. Numerous subjects would remain silent after pointing to their choices or would speak so indistinctly that their reason was incomprehensible. The experimenter often wished he knew what must have been in the child's mind but not on his lips. The letters of the alphabet were used as identifying marks for individual pictures in the test booklet. Some children used the

alphabetical sequence of these letters as the reason for their sorts. For instance, a child would have said, "L and M go together because L comes before M." Others sorted, offering reasons such as "they sound alike," "they look alike," or "don't know" and monotonously stuck with that until their 'ordeal' was over. Since there was no place in the test procedure to prompt or otherwise press the subject to alter his responses, there was no way out of this dilemma. Some children never caught on.

These problems with the use of the SCST on first-grade boys suggested that research into its validity and reliability with such subjects was necessary. Davis (1971) investigated the SCST using 23 items of Form A of the test. The Form M used in this study was a selection of those items from Form A that Sigel found best for male subjects. Davis administered the test to 120 students in the fifth, eighth and eleventh grades and in college. Test-retest reliability ranged from .35 to .87 when scoring was done according to response frequencies as it is in the current study. At the fifth-grade level, the reliability on the four major styles ranged from .67 to .86--all significant at the .01 level.

Problems were present in the item-response elicitation according to Davis. That is, some items of the test elicited only one or another style or inhibited the use of one or another style.

A tabulation of four of the ten troublesome items Davis (1971) identified was done with the data produced in the

present study. The items from the present study which were investigated were numbers 13, 14, 25, and 27. As Davis suggested, the responses were not elicited evenly. Item 13 did, as Davis found, elicit a larger proportion of Descriptive-global responses. Categorical-inferential responses were not exclusively produced by item 14, as Davis discovered, but much in that direction. Davis found that Descriptive part-whole responses were produced out of proportion on item 25. While that style occurred with high frequency on item 25, the notable discrepancy in the present study is between the complete lack of any Descriptive-global responses and the occurrence of 30 Relational-contextual responses. Item 27 replicated Davis' finding of no Descriptive-global responses, but did not elicit a high proportion of Categorical-inferential responses as Davis had found. This check of only four items hardly serves to indict the SCST. Nevertheless, the support that Davis' findings for fifth graders has in the above data for first graders served to suggest the need for investigating the use of the SCST with first-grade children.

Conclusion

The purpose of this study was to investigate the relationship, if any, between cognitive style as measured by the Sigel Cognitive Style Test (SCST) and intellectual maturity as measured by success on Piagetian number, length, substance, and weight conservation tasks. Building a

rationale on Halford's (1970b) model for conservation training and on experiments by Yeatts and Strag (1971), Peters (1970), Garrettson (1969), and Orpet and Myers (1970), this author hypothesized that there would be a relationship among cognitive style preference and/or flexibility and conservation ability.

Scores were obtained from 37 first-grade boys for cognitive style preference, flexibility and fluency; conservation ability; Peabody Picture Vocabulary Test (PPVT) IQ; and age in months. Four major categories of style in which the subjects could score were on the SCST: Descriptive part-whole (DPW), Descriptive-global (DG), Relational-contextual (RC) and Categorical-inferential (CI). The four major categories contained 20 subcategories. These subcategories were indicated by an abbreviation for the major style plus a number (e.g., DPW1, RC4, etc.).

To screen the independent variables, stepwise discriminant function analyses were completed. The variables which demonstrated predictive ability were then used in a stepwise multiple regression analysis.

Cognitive style was scored according to initial preference (first response for each item on the SCST) and total preference (total frequency of responses in each style category). Statistically significant results (α=.01) were obtained. Subjects' scores for their initial preference on two independent variables

accurately predicted their conservation score ($p < .05$). Those two variables were cognitive style categories that used comparison between figures (RC4) and age categories (DG5) as the basis for pairing items on the SCST. The best equation ($p < .01$) used a combination of seven variables. Those variables were cognitive style categories that used comparison between figures (RC4), age categories (DG5), common role or attribute (CI2), age and sex (DG7), thematic interaction or interdependent function (RC1 & 5), family or other relationship (RC6) and physical attributes (DPW1) as the basis for sorting. The Descriptive part-whole and Categorical-inferential style categories were positively related to conservation scores. Descriptive-global style was negatively related to the dependent variable.

Interpreting these results as they apply to the hypothesized relationship between cognitive style preference and conservation ability was difficult. The research cited in the literature review did not provide an explanation for these results. An explanation of the findings was offered on the basis of the nature of the correlations between the independent and dependent variables and the fact that subjects who scored high on conservation ability tended to use more style categories than the subjects who scored low. This suggested that subjects who obtained higher conservation scores used the Descriptive-global style infrequently and simultaneously enlarged their

use of the other style categories. Subjects who scored lower on conservation preferred the Descriptive-global style and exhibited a more limited repertoire of cognitive style.

The results gave a clear answer to the hypothesized relationship between cognitive style flexibility and conservation. Flexibility of style, fluency of response, PPVT IQ and age in months did not relate.

In summary, this study produced evidence establishing the role of cognitive style in conservation ability--a general expansion in the use of part-whole (analytical) and inferential styles and a decreased use of global style. It did not, though, indicate that one particular style preference related to conservation ability. Nor did it find flexibility of style to relate to conservation.

Some inadequacy in the use of a composite conservation score and some difficulties with the validity of the SCST were encountered.

This study suggested the need for investigating the use of the SCST with first-grade subjects. It also pointed to the necessity of further research into the relationship between cognitive style and conservation ability.

APPENDICES

APPENDIX A

SCORING CATEGORIES FOR SCST

DESCRIPTIVE (Stimulus Center): Concepts which are derived directly from the physical attributes of the stimulus and ones in which the conceptual label contains a direct reference to a physical attribute present in the stimulus.

SUB-CLASSES OF DESCRIPTIVE CATEGORIZATION:

These sub-types vary in terms of type of Descriptiveness employed. Their commonality rests on one direct reference to a denotable physical attribute. However, because of difference in cues employed, all Descriptive sub-categories should not be combined.

A. The following could be combined, if desired, as indication of DESCRIPTIVE PART-WHOLE.

D-1 Sorts in which the physical attributes or properties of the materials presented are the basis of similarity: e.g., color, texture, shading, or shape.

D-2 Sorts in which the description of the objects depicted are employed: e.g., heads, legs, guns, belts, clothing, etc., including posture, hair color, or any part of the object.

D-3 (Formerly D-7) Sorts based on (or dealing

Note: From Sigel Cognitive Style Test by Dr. Irving E. Sigel. This publication used by permission from Dr. Sigel.

specifically with) physical attributes (structural material): e.g., made out of wood, plastic, steel, etc.

B. The following could be combined as DESCRIPTIVE-GLOBAL. These categories appear similar to Categorical-Inferential labeling (C-2). At this time, separation is recommended since mere responses are based on the direct cue in the stimulus. Further research is necessary to ascertain the independence of this category. At this time, based on some analyses of data from children and adults, DESCRIPTIVE-GLOBAL categories appear independent of Categorical-Inferential. Thus, these responses, for the time being, should be kept separate.

D-4 Sorts in which the label designates the status, occupation, etc., where the cues are manifest in the stimulus: e.g., policeman, cowboy, WAC, nurse, etc.

D-5 Sorts in which discrete age categories are employed; e.g., children, old people, adults, babies, young people.

D-6 Sorts in which one of the sexes is grouped: e.g., males, females, men vs. women.

D-7 Sorts based on age and sex: e.g., old men, young women, boys, girls.

RELATIONAL-CONTEXTUAL: Concepts which are used to tie together (or relate) two or more people, objects, events, ideas. In this category no stimulus is an independent instance of the concept, each stimulus selected gets its meaning and its definition in the sort from a relationship with other stimuli: e.g., a scene in a mental hospital, a family scene, you can make a triangle out of this square, these two things could make a carburetor, alcohol comes from wood.

R-1 Thematic: Sorts which are based on themes, plots, or stories where no category is used: e.g., he killed this man, she is giving him food, etc. Sort implies interaction.

R-2 Geographical: Sorts in which the instances are related in space--locale, geographic, domiciliary, etc.: e.g., this man and this woman work in an office, this table with the chair belongs in the kitchen, they live in a jungle, they swim in water.

R-3 Temporal: Sorts in which the figures are grouped on the basis of the temporal development of the individual: e.g., this is a person growing up, these are the stages of life in a person, etc., or temporal sequence: e.g., before and after of a crime.

R-4 Comparative: Sorts based on comparison

between two figures: e.g., better than this one.

R-5 Functional: Sorts in which objects are grouped together on the basis of their interdependent use or function: e.g., the steam shovel digs sand to put on the truck, hammer is used to bang nail, ham and bread make a sandwich, this woman helps this man, they help us.

R-6 Sorts in which objects are grouped on the basis of an understood relationship state between the figures:

A. Kinship only: e.g., family, mother-son, etc.

B. Other relationship states: e.g., doctor-nurse, teacher-student, etc.

R-7 Sorts in which the objects are grouped together on the basis of a relationship to some social event, institution, or organization: e.g., these people have something to do with crime or with law, they are in the armed forces.

N.B. Because of the low frequency of some of these, all RELATIONAL-CONTEXTUAL sub-categories can be combined for analysis.

CATEGORICAL-INFERENTIAL: A group of objects are put together where each instance in the sort is representative of the total class. Each instance is not interdependent, characteristics are not necessarily observable, and a class label is used; it is an inference.

C-1 Sorts in which the objects are grouped on the basis of a common behavior or function: e.g., these people all work for a living, these people all do services, means or ways of transportation, foods we eat, machines we ride in, tools for building, beds to sleep in; and participles of action: e.g., people dressing, modeling.

C-2 Sorts in which the figures are grouped on the basis of an inherent common role, class, or attribute: e.g., animals, way of transportation, tools, professional people, violence, juicy, squarely, etc.

C-3 Sorts in which the basis of similarity is a moral or aesthetic value or judgment placed on the part of the object or figures. M: Moral--good, bad, wicked, evil (realm of right or wrong). A: Aesthetic--pretty, ugly, beautiful, attractive, etc.

C-4 Sorts in which the figures are grouped on the basis of a common affect state: e.g.,

sad, unhappy, happy, etc.

C-5 Sorts grouped on the basis of common locale, geographic, domiciliary, etc.: e.g., jungle animals, household furniture, underwater animals.

C-6* Selection of an unseen or presumed constituent part or inferred attribute of object or instance: e.g., seeds, motors, color other than black and white.

C-7 Value judgment which deals with evaluating something as to its intrinsic worth: e.g., something is useful, these are important for men, these are necessary, it is good for you to eat these.

N.B. The only sub-categories in this area that might be combined are those dealing with single attributes: e.g., inferred parts, like motors; inferred characteristics: e.g., they grow; such as C-3, C-6, C-7.

*Formerly a class labeling category, not combined with C-2.

APPENDIX B

SIGEL COGNITIVE STYLE TEST ITEM DESCRIPTIONS

Item#	Left Picture	Middle Picture	Right Picture
1	A - tomato	B - pear	C - apple
3	G - children	H - fish	J - snake
4	K - man 1	L - man 2	M - man 3
5	N - chair	O - floor lamp	P - table
6	R - banana	S - monkey	T - lollipop
7	V - uniformed man	W - man in suit	X - uniformed man
8	Y - axe	Z - man	A - saw
12	L - cow	M - horse	N - elephant
13	O - boy	P - man	R - girl
14	S - peanuts	T - string beans	V - grapes
18	F - sailboat	G - wrench	H - jeep
19	J - old woman	K - young woman	L - old man
20	M - horse	N - stage coach	O - dog
21	P - sliced loaf of bread	R - tomato	S - ham slice
22	T - girl	V - woman	W - baby
23	X - boy	Y - woman	Z - boy
25	D - horse	E - pickup truck	F - baby carriage
26	G - woman	H - man	J - nurse
27	K - tractor	L - speed boat	M - stage coach
29	R - uniformed man	S - nurse	T - man in suit
31	Y - orange	Z - melon	A - apple

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BIOGRAPHICAL SKETCH

Glen Howard Rediehs was born March 19, 1940, in Hinsdale, Illinois. He attended the Hinsdale public schools through high school. In 1959 he received an Associate in Arts from Concordia Junior College, St. Paul, Minnesota. He earned a Bachelor of Arts from Concordia Senior College, Ft. Wayne, Indiana, in 1961 with a major in theology and a concentration in psychology. Concordia Seminary awarded him a Bachelor of Divinity in 1965. In 1971 he was admitted to the degree of Master of Divinity by the same institution.

From 1965 to 1968 he served as pastor of Resurrection Lutheran Church, Orlando, Florida. In August, 1968, he began studies in the Department of Psychological Foundations, College of Education, University of Florida, Gainesville, Florida, and received the Master of Education in December, 1969. Since then he has pursued a Doctor of Philosophy from the same department.

Between 1968 and 1970, he was employed as a counselor in the Division of Housing of the University of Florida for one year and was a Graduate Fellow for one year. Since 1970 he has been an instructor in psychology at Valencia Community College, Orlando, Florida.

Hs is a member of Phi Delta Kappa and was elected to Phi Kappa Phi in 1969. In April, 1971, he married Patricia Lee (nee Bussell). They are the parents of an infant daughter, Kimberley Gayle.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

William Watson Purkey, Chairman
Professor of Education

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Robert Emile Jester, Co-chairman
Associate Professor of Education

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William E. Ware
Assistant Professor of Education

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Vernon D. Van De Riet
Associate Professor of Psychology

This dissertation was submitted to the Dean of the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August, 1973

B. J. Sharp by MC Butler
Dean, College of Education

Dean, Graduate School